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OF

POPULAR AND PRACTICAL ENTOMOLOGY.

EDITED BY

CHARLES V. RILEY.

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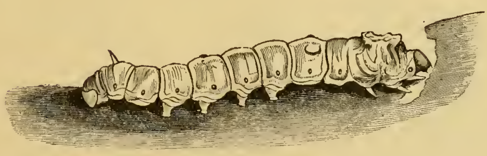

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ERRATA,

Page 3, col. 1, line 17, for *xanthomelina* read *xanthomelaena*.

Page 3, col. 2, line 24, transpose "Sonoma" and "Napa."

Page 7, col. 1, line 2, for *Laphrygma* read *Laphygma*.

Page 20, col. 2, line 7, for Libellutae read Libellulidae.

Page 30, col. 2, line 15, for *Beriplaneta* read *Periplaneta*.

Page 31, col. 1, line 46, for peninsular read peninsula.

Page 49, col. 2, line 29, for Litophane read Lithophane.

Page 51, col. 2, line 42, for *Pithecieum* read *Pithecium*.

Page 52, col. 1, Note, for *δиιτυον* read *δίκτυον*.

Page 80, for [Fig. 19] read [Fig. 20 *a*].

Page 81, for [Fig. 20] read [Fig. 20 *b*].

Page 92, col. 2, line 2, for *riberaria* read *ribearia*.

Page 97, col. 2, line 44, for attracting read attacking.

Page 98, col. 1, line 19, for *habillarde* read *babillarde*, *Curruca garrula* Briss.

Page 98, col. 2, line 39, for so minute a prey read such minute prey.

Page 99, col. 2, line 26, for cut-worm or green worm read cut-worms or green worms.

Page 102, col. 2, line 43, for *Calidryas* read *Callidryas*.

Page 108, col. 2, last line, for *Nutalli* read *Nuttalli*.

Page 122, col. 2, line 23, for shows read show.

Page 126, col. 1, line 12, for *Calidryas* read *Callidryas*.

Page 126, col. 2, line 19, for *purparum* read *puparum*.

Page 151, col 2, line 34, for *phillos* read *phellos*.

Page 152, col. 2, line 8, for *Microcentris* read *Microcentrus*.

Page 153, col. 1, line 43, for *g-batata* read *q-batata*.

Page 156, col. 2, line 4, insert a comma after "genus."

Pages 157 and 158 are omitted in the numbering.

Page 164, col. 2, line 13, for *Calydrias* read *Callidryas*.

Page 173, col. 1, line 41, for *Chrysobathris* read *Chrysobothris*.

Page 182, col. 1, line 7, for *Tiphleps* read *Triphleps*.

Page 200, col. 2, line 35, for *hicracifolia* read *hieracifolia*.

Page 200, col. 2, line 44, for *stellata* read *stellatum*.

Page 217, col. 1, line 42, for *Tettiigidea* read *Tettigidea*.

Page 230, col. 2, line 35, for *arvenis* read *arvensis*.

Page 239, col. 1, lines 19 and 27, for *vireus* read *virens*.

Page 239, col. 1, line 50, for Haldemann read Haldeman.

Page 257, second line under Fig. 128, for pressed read pressed out.

Page 260, col. 1, line 21, place the parenthesis after, instead of before, "lepidoptera."

Page 271, col. 2, line 35, for *puncticallis* read *puncticollis*.

Page 271, col. 2, line 59, for *monitifera* read *monilifera*.

Page 273, col. 1, line 2, for Galiodes read Galeodes.

Page 276, col. 2, line 32, for makes read states.

Page 286, col. 2, line 27, for cotylidons read cotyledons.

THE

American Entomologist.

VOL. 1. NEW SERIES. NEW YORK, JANUARY, 1880. NO. 1.

THE

American Entomologist.

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A. S. FULLER, Assistant Editor,........Ridgewood, N. J.

TO OLD AND NEW SUBSCRIBERS, GREETING!

It is now just nine years ago that we were penning the announcement that the "American Entomologist and Botanist" would be suspended for one year, and expressing our firm intention to commence issuing Vol. III. after the year's intermission. The temporary leave we then took of our readers has been extended far beyond the time anticipated. Business changes and embarrassment in the firm then publishing the magazine, the call of Dr. Vasey, the botanical editor, to Washington, to take the position of botanist to the Department of Agriculture; multiplication of our own duties; business depression—all conspired to protract the reissuing of the monthly.

It is with pleasure, heightened by the long delay, that we again address many of the former subscribers. We greet you as old friends, with the sincere hope and belief that the greeting will be mutual, and that you will assist in introducing us to many new readers.

The "American Entomologist" was originally begun by the late Benj. D. Walsh and ourselves, as a magazine devoted to practical and popular entomology. It is renewed as such, and we shall endeavor to adopt such new features as will make it a welcome visitor, not only to the cultivator of the soil, in any and every part of this broad land, who is endeavoring to successfully cope with the insects that injuriously affect his productions; but to every one in any way interested in the study of insects, from the amateur collector to the specialist. We shall endeavor to do this by publishing 1st, articles of permanent value on the habits and general natural history of species and especially of those that are beneficial or injurious to the agriculturist; 2nd, similar articles on physiology and anatomy; 3d, extracts and translations from contemporary entomological periodicals, both at home and abroad; 4th, general notes; 5th, extracts from correspondence; 6th, accounts of the doings of clubs and societies; 7th, notices and reviews of publications; 8th, answers to correspondents; 9th, local lists and purely descriptive matter.

Whenever lists or descriptions of species, unaccompanied by biological or other matter, and therefore uninteresting to the general reader, shall exceed in amount one printed page, the excess will be printed as additional to the ordinary reading matter, and charged to the author at first cost of printing, presswork and paper. In this way we offer, without infringing on the space to be devoted to topics of more general interest, a monthly Descriptive Department of unlimited extent to those authors who desire to insure the speedy publication of long descriptive papers. For the cost of thus publishing descriptive matter and for other business details we refer to the publisher's announcement.

While, as its name implies, the magazine will be devoted to Entomology, yet this science touches so intimately several other branches of natural science that we shall hope to interest other naturalists, and especially the botanist and ornithologist, from whom we invite contributions on entomophilous and insectivorous plants, the fungus diseases of insects, the food habits of birds, etc., and to whom we pledge our aid in furthering knowledge on these interesting subjects.

Conscious of the amount of labor and responsibility we assume in again presenting a special magazine of this kind for public favor, we should hesitate to do so, did we not have the promised assistance of a number of capable naturalists, and had we not associated with us in both the editorial and business management, Mr. Andrew S. Fuller of Ridgewood, N. J., a popular author on horticultural and natural history subjects, and well and widely known for his interest in entomology. Mr. Fuller will look after the interests of the magazine in New York, and contribute over his own initials.

Trusting to your indulgence, kind reader, we shall strive to co-operate with the other journals now devoted to entomology, in promoting and popularizing this fascinating and important science.—C. V. R.

Though we have hitherto merely announced our intention of renewing the *American Entomologist* in private correspondence, the cordial manner in which the announcement has been received is most gratifying. The following well known writers, among others, have promised their hearty support and occasional contributions: Dr. J. L. LeConte, Dr. A. S. Packard, Jr., Prof. Cyrus Thomas, Mr. J. A. Lintner, Mr. P. R. Uhler, Mr. E. T. Cresson, Mr. Edward Norton, Mr. B. Pickman Mann, Mr. W. H. Patton, Mr. H. F. Bassett, Mr. E. A. Schwarz, Prof. W. P. Barnard, Prof. E. A. Popenoe, Prof. O. S. Westcott, Prof. C. H. Fernald, Mr. Wm. H. Edwards, Mr. Henry Edwards, Prof. A. J. Cook, Prof. S. A. Forbes, Prof. J. H. Comstock, Mr. J. Parish Stelle, Mr. V. T. Chambers, Prof. F. G. Schaupp, Mr. J. D. Putnam, Mr. H. G. Hubbard, Miss M. E. Murtfeldt, Mrs. Mary Treat, and Miss Emily A. Smith.

All contributors who desire separate copies of their articles can have such at first cost of press-work and paper, upon expressing their wish to this effect to either the editor or the publisher. Paper covers will also be furnished when desired.

All communications or correspondence on entomological matters should be addressed either to the editor or the assistant editor, and all communications relating to business to the publisher.

Was ever the first number of a magazine satisfactory? We know that this, our first number of the new series, will possess faults incident to all beginnings and the many little unforeseen difficulties that accompany them. We crave the reader's indulgence, therefore, till the machinery of publication runs more smoothly.

Exchanges should be mailed direct to the editor at Washington, D. C.

The facts recorded in the present number on the food-habits of Thrushes, by Prof. Forbes, will be read with interest. In this general question of the value of birds to the farmer and fruit-grower, we have a decided individual leaning toward the side of the birds; though we have not wasted sentiment in characterizing the pernicious habits of some species. The habits of the same birds differ so much in different parts of the country and at different seasons, that it will be a long time hence ere impartial and accurate judgment can be pronounced on even the best known species. We do not hesitate to say, however, that the results of Prof. Forbes's investigations on the thrushes are surprising, and place these birds in a worse attitude toward the agriculturist than they have hitherto held, or than the investigations of others, as of Prof. Sam'l Aughey, of Lincoln, Neb., have

warranted; for while our knowledge of the food-habits of the Carabidæ is yet very incomplete, it is sufficient to show that they are decidedly carnivorous and beneficial to the cultivator of the soil.

IMPORTED ELM TREE BEETLE IN NEWBURGH, N. Y.

During the past summer the elm trees of Newburgh, N. Y., were almost entirely stripped of their leaves by some kind of insect pest which was said by the "oldest inhabitant" to be an entirely new thing in that part of the country. Through the kindness of Mr. Charles Downing and Prof. Alney, we procured specimens of the unknown pest in its various stages, which proved to be the *Galerucella xanthomelina* Schr., a small brownish beetle with one broad black stripe on each wing-case, and three black spots on top of thorax. It belongs to the Chrysomelidæ, a very extensive family of leaf-eating beetles, and although for some time known to be a pest of the Elm, its sudden appearance in such immense numbers in Newburgh, was an unwelcome surprise to the residents of that city, so long celebrated for its fine gardens and avenues bordered with noble elms and other choice ornamental trees. The residents of Newburgh, however, are probably more interested in knowing how to get rid of this pest, than in learning its natural history, and while we would be pleased to help them in this matter, it is quite difficult to reach the insects when feeding on very large trees. On small specimens it would be easy to dust the larva with lime, Paris green or other poisons, but it cannot be readily done on old trees; perhaps another season some parasite will come along and destroy them, or the birds, if permitted to work undisturbed, will clean out these pests.—A. S. F.

THE GRAPE PHYLLOXERA IN CALIFORNIA.

In 1871, before any trace of the Grape Phylloxera had been found in California, we pointed out the danger that threatened that State from the introduction of the insect, and urged the Pacific Coast grape-growers to take warning from Europe and guard against such introduction, as there was every reason to believe that the ravages of the insect would prove as destructive to the *vinifera* vines there, as it had proved in Europe. How fully experience has justified this warning will appear from the experience of a correspondent elsewhere.

It is fortunate for the California grape-grower that the insect has, to all appearance, there undergone a considerable modification in habit which very much limits its destructiveness. It is steadily spreading from infected centres, but very slowly indeed compared to its spread in France. Prof. E. W. Hilgard writes us that he believes this is due to the non-appearance of the winged female, as he has not been able to obtain it. If such is the fact it is one of the most curious modifications in habit, as a result of climate, that is on record, and will go far to explain the immunity in the Sonoma Valley while the Napa Valley is being ravaged, and the fact that the insect has not appeared in other parts of California. It also offers an additional incentive to grape-growers in other sections of the State to exercise the utmost vigilance to prevent the introduction into their own localities of infested vines or cuttings.

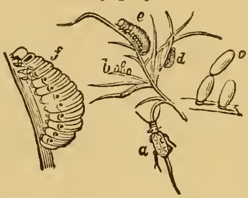
That the species may exist for an indefinite time without the winged female seems highly probable from the fact that the sexual individuals may be produced from hypogean females as well as from aërial ones. Yet so singular a change in the insect's nature can only be accepted upon most thorough and satisfactory evidence. This is easily obtained by half filling large glass jars with badly infested roots, interspersed with a little soil, about the time, or some time before, the grapes begin to ripen. If there are pupæ upon such roots, the winged females will soon begin to appear on the side of the jar toward the light.

THE ASPARAGUS BEETLE IN EUROPE.

We might naturally conclude that the farmers and gardeners of Europe would be as likely to know as well as anybody

how to destroy the common asparagus beetle (*Crioceris asparagi* Linn.) inasmuch as it is a native of their country and doubtless has fed on asparagus from its creation. But from notes on this insect recently published in foreign horticultural journals, we conclude that the English gardeners as well as those on the other side of the Channel have not as yet discovered or adopted the Yankee method of subduing this little pest.

[Fig. 1.]



CRIOCERIS ASPARAGI:—*a*, beetle; *b*, eggs; *e*, *d*, larvæ; *f*, same enlarged; *c*, eggs, enlarged.

That most excellent journal *The Garden* (London, Eng.), has recently published a series of very thorough, practical articles on asparagus and its culture. The author (Godefroy Lebœuf) in the closing number describes several of its insect enemies, among the number the asparagus beetle, as follows:

Crioceris asparagi is a small beetle, long in the body, and of a red colour, speckled with grey and white spots. The larvæ are somewhat cylindrical, narrower towards the head, and are of a dirty olive-green colour, fleshy and shining. It only lasts in the larva state for about ten days, but during that time it commits the most formidable ravages. It deposits its eggs on the tenderest parts of the asparagus, which are speedily attacked by the young larva as soon as it comes out of the egg. These destructive insects will devour a whole plantation in a brief space of time if their ravages are not checked immediately they are perceived. Incessant war must be made against both beetle and larva. If there are only a few they may be crushed between the finger and thumb. They must especially be looked for during bright sunshine, which is the time they generally make their appearance. If they are too many to be destroyed in this way, we must take a bowl or other vessel full of water, and holding it under the asparagus, tap the stems lightly, so as to shake off the insects into the water. As soon as they feel the blow their instinct teaches them to imitate death and drop off the shoot. When all have been caught the water may be thrown on the ground and the insects crushed to death with the foot; or, what is better still, the cold water should be strained off and boiling water poured on them. The Asparagus-beetle lays twice a year—in the spring and in June or July.

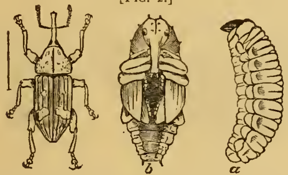
Hand gathering by crushing between finger and thumb or shaking off into a bowl of water might do where one had only a few clumps of asparagus, but it is entirely impracticable on large beds, or plantations extending over many acres, as are found in the suburbs of all our larger cities. The Asparagus-beetle appeared in this country some twenty or more years ago and threatened for a time to destroy the extensive asparagus plantations on Long Island, as well as to spread to other parts of the country, but some one soon discovered that freshly slaked lime scattered over the plants would almost instantly kill every larva it touched, and two dustings were sufficient to destroy the entire brood. A second brood may appear later in the season, because a few larvæ may escape ever so thorough a dusting, and because there are always some wild asparagus plants about, to which nobody pays any attention, and on these a few hundreds or thousands of insects breed without being disturbed. Consequently the entire stock of this pest in any one locality is not likely to be annihilated, even if all are killed that appear in gardens. But the lime is not only a very cheap and effectual cure for the evil, but one readily obtained in all parts of the country. With a pail full of dry lime and an old broom for a duster, or one of the sifters used for applying Paris green to potatoes, a man can soon go over an acre of asparagus. The best time to apply the lime is in the morning while the dew is on, for then a portion will adhere to the plants as well as to the grubs, and during the day or days, following, it will be constantly dropping down, or blown about among the leaves and branches, thereby making the escape of any larvæ all the

more uncertain. The lime is also beneficial to the asparagus roots, hastening the decomposition of the manure usually applied in large quantities to the beds. For the past sixteen years I have used lime as described on my asparagus beds, to keep the insect in question in check, and it has done it so effectually that about one application every alternate season has been sufficient.—A. S. F.

A GOOD WORD FOR THE WHITE PINE WEEVIL.

Whether the trait is the result of education or otherwise it is quite evident that man is far more ready to condemn than praise the creatures, of whose history he knows the least. Things are usually looked upon as bad until something good of them is learned. The masses place all insects, with a few rare exceptions, like the Honey-bee and Silkworm, among the evils of this world with which we are compelled to contend in our struggles for existence. That

[Fig. 2.]



Pissodes strobi:—*a*, larva; *b*, pupa; *c*, beetle;—hair-line showing natural size.

there are a vast number of species which do more or less interfere with our pleasure and profit is doubtless true; but to attempt to draw a line between those that could be wholly dispensed with, and the really beneficial, would require more wisdom than usually falls to the lot of the most able naturalist. As an illustration of the good work, or assistance which one may receive from an otherwise destructive species of insect I will cite the operation of the White Pine Weevil (*Pissodes strobi* Peck) on my own grounds. Some ten years ago when this insect appeared among some pine trees growing in nursery rows, I concluded that all would soon be ruined, for every leading shoot was thoroughly perforated by the grubs and of course killed. The loss of the leading shoot, however only checked the upward growth of the main stem and soon the next tier of branches bent inward filling up the open space, and the loss of the leader only made the side shoots grow the more vigorously and the trees really assumed a better and more stocky form than before. Of course in small nursery trees the continued loss of the leading shoots of White and other species of pine would be more or less detrimental because a tall slender growth might be preferred to a short and stocky one, and the nurseryman could manage this matter to suit himself better than with the aid of these insects: still I am inclined to think that the Pine Weevil has in many instances done a little beneficial pruning that would otherwise have been neglected; for most persons, and even good gardeners, are often very averse to cutting out the leading shoots of evergreens, an operation which is quite important in producing good, broad, stocky specimens, suitable for planting singly or in groups upon a lawn.

This Pine Weevil does not however confine itself to the pines, but also attacks the spruces and to these it is far less injurious, because new shoots are produced from latent buds on all parts of the wood and the loss of a leader is soon made good by several new side shoots, and the effects of the check is to make the whole top fill up and assume a more graceful form than if left to grow unmolested by the weevils. Since the advent of this Pine Weevil on my place many of the large Norway spruces have been greatly improved in their appearance by the almost annual destruction of the terminal or leading shoots, and no one would question the benefit of this kind of pruning after a glance at the trees, comparing the weevil-pruned with those that have escaped. I have only to regret that these insects do not visit every specimen on my grounds, for it is no easy task to get at the leading shoot of a Norway spruce thirty or more feet high, and take it out with knife or shears. If this is not done occasionally, the trees grow altogether too tall and are too poorly furnished with lateral branches, to come up to my idea of perfection. Of

late years I permit the White Pine Weevil to have its own way among my spruces, merely limiting the number at work among the small stock in nursery rows. —A. S. F.

ON THE HIBERNATION OF THE COTTON WORM.*

Aletia argillacea Hübn.

No question connected with the Cotton Worm has given rise to more speculation than that of the hibernation of the insect, and this fact at once finds its explanation in the difficulty that surrounds the subject. As partly illustrating this difficulty it will be well to elaborate the statements in a paper read by the writer before the National Academy of Science at its meeting in Washington last spring. There are three principal theories on the subject that are worthy of consideration, and that are held by those with whom I have come in contact or with whom I have corresponded. These are :—

1st.—That it hibernates in the chrysalis state.

2nd.—That it hibernates as a moth.

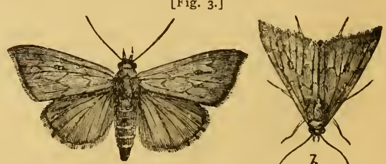
3d.—That it does not hibernate in any part of our cotton-growing States, but comes into them on the wing from warmer climates where the cotton plant is perennial.

Some few persons think that it winters in the egg state in cotton seed or on the dead stalk of the plant ; but such views may be disposed of by the statement that they are unsupported by even the appearance of fact.

At first blush it would seem easy enough to dispel whichever of these theories is erroneous and settle the question under consideration by a few simple facts of observation. The trouble is, however, to get at the facts.

About one fourth of the intelligent people of the South hold the opinion that this Aletia hibernates in the chrysalis state, some believing that it does so above ground; others that it retreats beneath the surface of the ground. It has generally been stated by the writers on this insect, that the chrysalis could not endure the slightest frost. I have been able to prove that it will suffer with impunity a temperature of from five to ten degrees below the freezing point, but that it cannot withstand a lower temperature ; and all those chrysalids which do not give out the moth, before severe cold weather sets in, perish beyond any doubt. How easily men are misled even on this point, however, may be gathered from the fact that Dr. E. H. Anderson of Kirkwood, Miss., a most intelligent observer and experienced cotton planter, kept what he believed to be living specimens until after the severe cold of December 1878. A careful examination proved that the life-like motions of such chrysalides were due to the living pupa which they contained of one of the parasites (*Pimpla conquisitor*) presently to be described. The larger proportion of chrysalides that are not empty after a severe frost has occurred, are infested with some kind of parasite, though many of them have perished from the effects of the frost and are either rotten or moldy. Any number of intelligent planters insist that they plow up the chrysalides in spring, and the belief that the last brood works beneath the ground, out of reach of frost, is very firmly held by some of the most experienced cotton growers ; but, in every instance that has come to my knowledge, the chrysalides thus plowed up have proved to belong to other species, most of them of the same family, and many of them having a sufficiently close resemblance to those of Aletia to confound any but the most skilled and experienced entomologist. As an illustration of the ease with which erroneous conclusions can be drawn from mistaken identity, I will here quote part of a letter received last Spring

[Fig. 3.]



ALETIA ARGILLACEA : *a*, moth wings expanded ; *b*, do. wings closed and head downward (after Riley).

* From advance sheets of Bulletin 3 of the U. S. Entomological Commission, by C. V. Riley.

from Prof. J. E. Willet, one of our observers who has particularly interested himself in this subject.

"I have received to-night" writes Prof. Willet, "from Rev. Robert Harris of Cairo, Thomas Co., Ga., a small tin box enclosing 25 chrysalides, which I forward you by mail. Mr. Harris is an ardent believer in the subterranean hibernation of the chrysalis of *Aletia argillacea.* I transcribe the portion of his letter pertinent to the case.

'Cairo, Ga., Feb. 22, 1879.

Washington's birthday and victory. *Perseverantia vincit.* The facts drive "analogy" to the wall. Here they are: 25 Cotton Worm chrysalides ploughed up out of the ground, in a field that was riddled by the insects last fall.

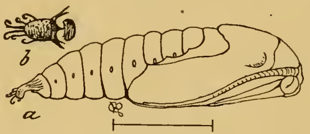
This is unimpeachable evidence and, in the opinion of the court, is amply sufficient to convict the prisoner.'"

"The chrysalides," continues Prof. Willet, "appear to my eye very like *Aletia* chrysalides which I have in spirits and I await your verdict with interest."

The chrysalides referred to in this instance resemble those of Aletia so thoroughly in form, size and general appearance, that they might have been mistaken therefor even by some entomologists; yet from certain minute structural differences, easily observable with a good lens, I was able at once to decide that they belonged to another insect, the *Aspila virescens* of Fabricius, a beautiful moth with olivaceous primaries marked with three distinct pale transverse lines relieved by coincident deeper shades, the translucent green larva of which, speckled with minute pale fleshy elevations, I have found feeding on *Solanum sieglinge* in St. Louis.*

There are many species of night-flying moths which go through their transformations beneath the ground and there hibernate in the chrysalis state. The leaves of the cotton plant are palatable to a very large number of such, while the Boll Worm, (*Heliothis armigera*) and the "Grass Worm" (*Laphrygma frugiperda*) which thus transform are sometimes very abundant in a cotton field. It is not at all surprising, therefore, that chrysalides should be plowed or dug up in land planted to cotton. All of them, upon careful scrutiny, will be found to differ from the chrysalis of Aletia, which may be distinguished by its slender form, and particularly by the tip of the body with its armature, as shown in the accompanying Fig. In short, the nature of the Aletia chrysalis effectually prevents it from working beneath the ground except where, dropping out of its cocoon, it happens to fall into some crack or crevice and thus wriggle beneath the surface. It is, also, contrary to all analogy that a chrysalis normally formed above ground in a cocoon should work beneath the soil; for all insects that pupate underground, descend while in the larva state.

[Fig. 4.]



PUPA OF ALETIA.—*a*, cremaster from side; *b*, do. from beneath, still further enlarged.

Experiments which I have repeatedly made prove that the Aletia chrysalis, when placed under ground, either rots and perishes, or the moth—if in a sufficiently advanced state when the chrysalis is buried—will vainly attempt to escape and push through its unnatural surroundings.

Regarding the ability of the moth to survive the winter, nearly one half of the more intelligent correspondents state that they have known it to be found flying during warm days in the winter and that it consequently hibernates in that state. Mr. Jno. T. Humphreys of Morgantown, N. C., who was, for a while, employed by the State of Georgia in entomological work, says that he has absolute proof of the hibernation of the moth.

Page after page of testimony and experience from the most competent and reliable planters might be adduced in support

* I append a description of the larva. Smooth, soft, translucent, with the normal complement of 16 legs. Color either green or lilaceous. Finely speckled with pale yellowish spots, (appearing under the lens as fleshy elevations) arranged in a somewhat longitudinal manner, and forming along the stigmatal region a tolerably well-marked band, the stigmata, which are in the upper portion of this band, being black with a carneous centre and white annulation. Piliferous spots in normal position, very small, dark, with a paler annulation; the hairs fine and translucent. The two posterior joints somewhat squarely cut off. Head, thoracic legs and cervical shield polished, slightly more yellow than body. Full grown in July; imago issuing in August of same year.

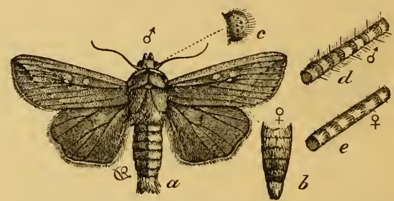
of the fact that the moth is to be seen either hidden in sheltered situations or flying during the milder weather of winter, and in spring, in all of the Southern portion of the belt.

The situations in which it is most often reported as sheltering are under the shingles of gin houses, under rails, and under the loose bark and in the hollows of trees and prostrate logs. In old pine stumps the sap wood separates from the heart wood and forms excellent retreats for this purpose. The general hue of the large scales of pine bark is sufficiently close to that of the moth to make the resemblance protective. A dense forest of Long-leaved pines also modifies and equalizes the winter temperature. These facts would lead one to suppose that pine forests offer unusually favorable conditions for hibernation, and Mr. Humphreys has, in fact, found the moth hibernating under pine scales, while some of my most reliable correspondents report having seen the moths sporting in great numbers in the edges of pine forests during the month of March. Nevertheless, the persistent search, by Mr. Schwarz last winter, under my direction, while yet connected with the Department of Agriculture, failed to reveal the moth under pine bark; whereby I was led to the conclusion that it seeks winter shelter some distance from the ground. It has been reported by some correspondents in greatest numbers in swamps of Sweet gum, Oak, Magnolia, Poplar, etc., such as are found in Southern Alabama. These swamps are warm, moist, and miasmatic, and the moths are said to have been seen literally packed together in a torpid state in such places, in the hollows and burrows made in rotting logs by boring larvæ.

The evidence on this point of the hibernation of the moth would be overwhelming did it come from scientific observers; but, unfortunately, allied species are so often and so easily mistaken for Aletia that doubt still surrounds the subject. The liability to confound hibernating species is all the greater, in that their characteristic markings are more or less effaced or faded. The *Hypena scabralis* (Fabr.)* a moth, belonging to a different family (*Pyralidæ*) and which hibernates in the imago state all over the country, is especially common in the Southern States and large numbers have been sent to me as the genuine Aletia. It is nearly of the same size and form, and while normally of a darker brown, faded, hibernating specimens are easily mistaken for the Cotton Moth because of undulating darker lines across the front wings somewhat similar to those on the latter. Its palpi are longer and snout-like, and its front wings invariably lack the dark discal spot and the white specks characteristic of Aletia.

Phoberia atomaris Hübn., and many other similar moths have been forwarded with the remark that they were the Cotton Moth; while *Leucania unipuncta* Haw., the parent of the Northern Army Worm—which feeds on grasses and cereals—is everywhere found in the South during winter, and, on account of its great similarity in color to Aletia, and of a white discal spot relieved with a dark shade on the front wings that heightens the general resemblance, is more often mistaken therefor than any other. It is more robust than Aletia, and a comparison of the accompaing illustrations (Figs. 3 and 5) will show the other differences. From this danger of confounding species it is evident that ordinary reports lose—when unaccompanied by specimens—much of their value

[Fig. 5.]



LEUCANIA UNIPUNCTA: *a*, male moth; *b*, female abdomen, natural size; *c*, eye; *e*, portion of female antenna; *d*, do. male (after Riley).

* The *Platyhypena scabra* (Fabr.) of Grote's List. Its larva is grass-green in color with a medio-dorsal, and sub-dorsal lines of a darker green, the latter bordered below by a whitish line. It is cylindrical, and with but three pairs of abdominal prolegs. It feeds on clover, and also on *Robinia*. The chrysalis is formed in some sheltered situation and surrounded with white silken threads; is dark and slender like that of *Aletia*, but the tip is armed with two strong, slightly diverging spines. In Missouri this chrysalis may be found under bark during winter, and it doubtless hibernates in both chrysalis and imago states in the South.

and must always be taken *cum grano salis.* Yet, after making due allowance for possible error, the number of intelligent planters whom I have conversed with, and who, having long and thorough acquaintance with the moth, feel positive of their ability to distinguish it and of having seen it during the winter, is so great as to leave little doubt of the fact; while the added testimony of Prof. Grote, who is such authority on moths that he could not thus confound species, and who states that he has found the Aletia in Alabama during mild winter weather, should dispel even that little doubt; and we may safely consider as proven that the moth does survive the winter up to the end of March. The general experience of correspondents is, however, that after March these hibernating moths are no longer to be seen, and no one knows what becomes of them between this time and the appearance of the first worms.

The difficulty felt in bridging this gap together with the progress of injury from the South northward have given rise to the theory that the species cannot survive the winter in this country, and must necessarily come each year on the wing from some exotic country where cotton is perennial. Mr. Robert Chisolm of Beaufort, S. C. seems to have been the first to suggest the theory, but the first published statement of it that I can find is by a Dr. Gorham who, in 1852, distinctly says:* "my speculations on the nature and habits of the Cotton Fly have led me to adopt the following hypothesis: That it is a native of tropical climates, and never can pass a single winter beyond them, consequently never can become naturalized in the United States, or any where else where the cotton plant is not perennial."

Two years later it was more fully set forth by Dr. W. I. Burnett,† from facts communicated by Mr. Chisolm, and lastly it was again urged, as original, by Prof. Grote in 1874.‡ Prof. Grote's conclusions were "*that it dies out every year* (*with its food plant*), *that it occurs in the cotton belt of the Southern States, and that its next appearance is the result of immigration.*

The principal arguments urged in support of the theory by Prof. Grote are (1) the *sudden* appearance of the moth in quantities; (2) the first appearance of the worms so late as the latter part of June; (3) the absence of parasitic checks; (4) the highly probable exotic origin of the species and introduction into the States; and (5) the power of flight and migratory habits of the moth. The first three lose much of their force from the facts adduced in this bulletin, since (1) in the Southern portion of the belt the sudden appearance is more apparent than real, (2) the worms appear in April, and (3) they have numerous parasitic checks. There is also little force in the fact of original introduction from some foreign country, since most of our worst insect pests that are now acclimated and established with us, were originally introduced from abroad; while (4) the migratory habit, as we have seen, is not developed in the first moths. Arguments urged by others in favor of the theory are (6) the periodical visitations and intervals of immunity; (7) the short life of the moth; and (8) the failure of those who have tried to keep it through the winter. To these it may be replied that (6) many other indigenous insects abound during certain years and are unknown in others, and that these changes are due to the working of well known laws; that periodicity of *Aletia* is largely imaginary, because it either refers only to bad years and takes no stock of small numbers, or else is local. The investigations of the Commission show that the worm has been in some part of the South every year since the civil war, and there is no reason to suppose that it was not annually to be found in fewer or larger numbers prior thereto.

(7) The short life of the moth of the summer generations is no criterion for that of the last or hibernating brood, since any number of species which produce several annual generations and have but a brief span of life in the imago state in summer,

* DeBow's Industrial Resources of the Southern and Western States 1852, p. 169.
† Proc. Bost. Soc. Nat. Hist. 1854, Vol. IV, pp. 316–17.
‡ Proc. A. A. A. S., 1874, B. p. 28.

are known to hibernate in this state. (8) It is extremely difficult to attain, in a room, the proper conditions of moisture and freshness that belong to a sylvan atmosphere, and I have never been able to keep other hibernating Lepidoptera alive through the whole winter in such artificial situation, though I have tried with both *Danais archippus* and *Paphia glycerium.* For this reason it will always be next to impossible to get *absolute and incontrovertible* proof of the hibernation of Aletia by watching the moths from fall till they oviposit the following year, but it may be truly said that if the hibernation of other species rested on equally absolute proof, there is not one among the Lepidoptera, or other Orders for that matter, that could be said to hibernate. One other argument that has been made in favor of the theory may, lastly, be mentioned. It is that during the late war no cotton was grown for three years in some sections of the South, and that the first crop raised thereafter was infested. Prof. Comstock took particular pains to make inquiries on this head, and found that some patches of cotton had been grown every year in such sections.

In favor of hibernation in the Southern portion of the cotton belt may be urged (1) the appearance of the moth on the wing during mild winter weather, and its being found torpid in sheltered situations, as insisted on by so many; (2) the first appearance of the worms in small numbers, as attested by recent observations; (3) their re-appearance each year in the same spots, not on the sea coast nearest to the tropical zone, where we should expect them on the theory of annual incoming, but at various points far inland; (4) the coming of the moths in large numbers and as immigrants into the Northern portion of the belt being always preceded by the appearance of the worms and their gradual increase at some other, generally more Southern or Western point; and (5) the decrease of cotton culture in Central America and the West Indies, as appears from market statistics, and the utter absence of the worm in the Bahamas since 1866, as ascertained by Mr. Schwarz while there last spring.

The strongest fact against hibernation is, perhaps, the period elapsing between the disappearance of the moths in March and the first appearance of the worms, or, to put it in another form, the absence of the worms on the young and tender cotton. The period during which the species is not to be seen is already reduced, by the facts in this bulletin, to less than one month instead of three, and this is much less than the time which elapses between the issuing from winter quarters of other Lepidoptera that hibernate as imagines and the first appearance of their larvæ; numerous illustrations of which fact might be cited.

On the whole, therefore, the weight of evidence is strongly against the theory of annual extermination in the Southern part of the belt, and the fact of the hibernation of Aletia there may be said to rest on as good evidence as that of many other species in which it is admitted without question. Yet Aletia is, beyond doubt, killed out each winter in the Northern portion of the cotton belt, and all the arguments in favor of annual extinction and incoming *de novo* have force when restricted to this section. Just where the separating line lies between extinction and survival is not easy to decide, and for the present I can only refer to that given in the Introduction (see p. 15) as the result of the investigation so far as it has gone.

This conclusion that the moth does and can hibernate in the United States does not preclude its occasional incoming from foreign, more tropical countries; or the possibility of its being brought by favoring winds from such exterior regions, just as originally must have been the case when the species was first introduced. The facts indicate, however, that this kind of immigration is less frequent at the present time than it was in the beginning of the century.

To sum up the evidence from present knowledge: Aletia never hibernates in either of the first three states of egg, larva, or chrysalis; and it survives the winter in the moth or imago state only in the Southern portion of the cotton belt. My own in-

vestigations during the past two years in every State in the Union except South Carolina and Florida (which have been visited by Mr. Schwarz), together with the experience and testimony of correspondents and of special agents employed in the investigation, confirm me in these conclusions, and I will close the discussion with two other suggestions that grow out of this experience.

1. It is quite certain that by far the larger portion of the moths from the last brood of worms perish in various ways without perpetuating the species. All those which fly North of the cotton belt must needs thus perish, as doubtless do all those that attempt to hibernate in the Northern portion of said belt. The evidence is strong that even in the hibernating portion of the belt, only the exceptional few, more favored than the rest and remaining steadily torpid till early spring, suvive to beget progeny. Those which are aroused to activity during mild winter weather, spend their force without finding compensating nourishment, as there are neither fruits, flowers, nor sweet-secreting glands at that season wherewith to break their long fast and sustain vitality. It is for these reasons that the worms are generally less injurious after mild and changeable winters and most to be dreaded after severe and steady ones, and it may very justly be argued that, did the larger proportion of the moths survive, there would be no chance to grow cotton. Like perishing of the bulk of most insects that hibernate above ground, is, in fact, an acknowledged rule in entomology.

2. The localities where Aletia doubtless hibernates and where, consequently, the earliest worms appear, seem to be more common in the Western parts of the cotton belt than in the Atlantic States. Since the civil war the almost complete abandonment of cotton cultivation on the Sea Islands off the coast of Florida and Georgia has evidently reduced the number hibernating there, and, in so far, protected the more Northern and Western portion of the Atlantic States from the immigration of the moth from those quarters. In Texas, on the contrary, the cultivation of cotton has been constantly increasing since that time, and, consectaneously, the number of favorable hibernating points, and the risk of serious harm there over extended areas, have also increased.

PEACH TREE BORER INFESTING ALMONDS.

During the past half dozen years the double white and pink almond shrubs growing in my garden have shown signs of being badly diseased. At first I thought little of it, as these shrubs are plentiful and multiply quite rapidly by suckers, but so many died outright, that I was led to make a careful examination of their roots, and in these, and in the stems just below the surface, large numbers of the larva of the common peach tree borer (*Ægeria exitiosa*) were found. Peach trees being but little grown in my neighborhood the borers took to the almonds and here kept at work until few good plants are left. Having quite a large number of the almonds and seeing that the borers were well established, I concluded to leave them undisturbed in order to watch their progress during the summer, and ascertain if Harris was correct in saying that the moths appeared at all times from June until October. At various times during the summer I dug up almond plants, and invariably found grubs of all sizes, from those a few days old up to the nearly or quite full grown, but no pupæ were discovered under the bark or in the earth immediately surrounding the wood, a fact that leads me to believe that the grubs go a much greater distance from their burrows before passing into the pupæ state than is generally supposed. Pupæ that are so frequently found in the gum exuding from peach trees are probably imprisoned there and cannot get away, else they would do so and find a more congenial place for passing through their final transformation. Harris states that the pupæ are found in the gum of peach trees; also under the bark and in the ground; but so far as my own observations extend I conclude that they will always seek the latter.

The old dwarf almond bushes in gardens are excellent breeding places for this insect, and it would be well for all who love such plants to examine them occasionally, and destroy all the grubs found. Peach trees may be protected with tar-paper bands but this is not practicable with such slender and free sucking plants as the dwarf, flowering almond.—A. S. F.

THE GRAPE PHYLLOXERA IN SONOMA.

A correspondent who has large interests in California grape-culture and who has recently returned from an extended visit to the richer wine-producing sections of the State, but who does not wish his name to appear, gives the following account of his observations in the Napa and Sonoma valleys:

When I arrived in California, last summer, already at San Francisco my attention was called by nearly every vine grower to the ravages which the Phylloxera has caused in the different wine districts. Each one had to add some bad news to the common stock, and all agreed that so far no remedy, that had proved reliable, had been found.

My first visit in the interior was to the Napa Valley, where, from Napa City, northward, nearly 50 miles of unbroken vineyards adorn the hilly borders of the Napa Creek. Personally acquainted with nearly every one of the wine-growers there, I received from all of them the assurance, that not a single case of Phylloxera had been detected in their vineyards.

Mr. Chas. Kane, the oldest of the large Wine-growers of the Valley, and President of the Wine-growers' Association of the St. Helena district, the most important Wine district (both as to quality and quantity produced) of the whole State of California assured me, that he and his neighbors had investigated a great quantity of sick-looking vines, but could never find any signs of Phylloxera; I lay stress upon this fact, because only a few miles distant, across a low range of hills where the Sonoma Creek drains the beautiful Sonoma Valley, the Phylloxera has destroyed hundreds of acres of vineyards; and has been established there for the last five years.

What may account for the non-existence of the insect in one valley and the rapid increase of the plague in the other, only a few miles distant, nobody seemed to be able to answer positively. Some believe that the richer soil of the Napa Valley does not favor the development and increase of the insect so well as the gravelly bottom of the Sonoma Valley; while others say that the careful treatment and greater cleanliness of the vineyards of Napa shield them from the insect. It must be acknowledged, that no deserted vineyards or even disorderly kept vineyards can be found in the Napa Valley, while in the Sonoma Valley it forcibly strikes the visitor, that before reaching Sonoma and after Sonoma is passed, there are many vineyards which seem to have been entirely deserted. But at the same time, I can state from what I saw myself, that even the best cared-for vineyards are not safe from the insect in Sonoma Valley. I have seen vineyards there as well treated and in as good order (and known to have been so for years), as any in the whole State of California and still the Phylloxera was working with terrible effect.

In this valley nobody was able to give any suggestion as to how the insect might be fought successfully. It seemed that every variety of vine planted in the valley had been attacked and was finally destroyed, or being destroyed.

THE FOOD-HABITS OF THRUSHES.

Prof. C. V. Riley.

Dear Sir: I summed up, recently, my notes of the contents of the stomachs of 150 birds of the Thrush Family (*Turdidæ*), and as some of the general results are quite unexpected to myself, I infer that they may be interesting to others. Forty-one of these birds were Robins; thirty-seven were Cat-birds; twenty-eight, Brown thrushes; eleven, Wood thrushes; eighteen, Hermit thrushes; eight, Alice's thrushes; six, Swainson's thrushes, and one was a Wilson's thrush, or Veery. They were shot in central, western and northern Illinois, in various months, from March to September, and during four successive years, chiefly, however, in 1876 and 1879.

The number of specimens is, of course, too small to allow conclusive generalization; but as I think no equal number of specimens has been previously studied *with equal care*, it will probably be fair to state some of the results as hypotheses, more or

less probable, but requiring verification by further study.

The most fruitful peculiarity of the *method* used was the careful estimate, for each specimen (after a critical microscopical examination of the contents of the stomach), of the relative *amounts* of all the elements of the food, and the subsequent averaging of these ratios for the species. By this means I determined the hitherto unsuspected fact that the family is inordinately destructive to predaceous beetles (*Harpalini*), seven per cent. of the food of the 150 specimens consisting of these highly beneficial insects. When we remember that one predaceous insect must destroy many times its own bulk of other insects during its life, we see the importance of this fact in respect to the economical value of these birds.

Between the *Turdidæ* and other families, I can make only the following crude comparison in this particular. Of the 150 Thrushes examined, forty-six *per cent.* had taken *Carabidæ*, while of 194 birds of other families in whose stomachs insects were found, less than five *per cent.* had eaten these Coleoptera.

The worst sinner in this respect was the Hermit thrush; while the Alice thrush and the Wood thrush had eaten comparatively few. Curiously, the ratio of *Carabidæ* continued undiminished during the fruit season, when the total of insect food fell away very rapidly. For example, the Cat-birds ate in May, June and July, eighty-seven *per cent.*, sixty-four *per cent.* and eighteen *per cent.*, respectively, of insect food, while the *Carabidæ* for those months averaged seven *per cent.*, six *per cent.* and ten *per cent.*, the corresponding fruit record standing nothing, thirty *per cent.* and seventy-one *per cent.*

The following genera were distinguished among the *Carabidæ*: *Scarites*, *Dyschirius*, *Platynus*, *Evarthrus*, *Pterostichus*, *Amara*, *Brachylobus*, *Geopinus*, *Agonoderus*, *Anisodactylus*, *Bradycellus*, *Harpalus* and *Stenolophus*. The absence of all, or nearly all, the specially protected genera is noticeable (unless the obscure color of many is reckoned a special protection). A single *Cicindela* (*C. lecontei*) was found in the stomach of a Cat-bird.

I was further interested in the apparent specific differences in the food of allied species, occupying the same ground at the same time and drawing their food from the same sources of supply.

The Robin and the Cat-bird differed materially in the number of ants and myriapods destroyed, the former eating very few of either (one *per cent.* and two *per cent.*, respectively), and the latter many (viz.: ten *per cent.* and six *per cent*). The Brown thrush departs from all the other members of the family in its fondness (?) (perhaps it is stern necessity which forces him to this miserable shift), for insects and fragments of grain picked from the droppings of stock. Twenty-eight *per cent.* of the food of those shot in April was derived from this source, and another eight *per cent.* consisted of carrion beetles (*Silphidæ*).

This bird was further distinguished from the Robin (as is the Cat-bird also), by the absence of the larva of *Bibio albipennis* Say (kindly determined for me by yourself*), which made over half the food of the Robin in March. It is important to recall, as throwing light on the question of fixity of food habits over large areas, that Prof. Jenks, now of Brown University, found nine-tenths of the food of a large number of Robins whose stomachs were examined by him in Massachusetts, in March and April, 1858, to consist of this same larva.

The above particulars and conclusions will serve to give some idea of the interest and promise of this subject, if it is studied with as near an approach to the strict scientific method as the circumstances will permit.

For full details of the observations thus far made upon this family and a much more elaborate discussion of them, you are respectfully referred to the forthcoming Vol. 13, Trans. Ill. State Hort. Soc.

Very truly yours,

S. A. FORBES.

Ill. State Lab. Nat. Hist.
Normal, Ill., Dec. 11, 1879.

* These larvæ had been previously determined as Tipulid larvæ by the entomologist of the Department of Agriculture. —Ed.

ROSE-FEEDING TORTRICIDÆ.

THE ROSE LEAF-TYER (*Penthina cyanana*, n.sp.)

BY MARY E. MURTFELDT, KIRKWOOD, MO.

The "Queen of flowers," like some queens in higher orders of life, has many insidious enemies. Hovering about her, in court attire of gauzy or gaily painted wing, are myriads of insect courtiers, all apparently paying homage to the charms of her floral Majesty but in reality intent only on inflicting the secret wounds from the effects of which her beauty wastes and her health declines.

Among the numerous insects with which the florist has to contend for the perfection of his favorite flower, are no less (and probably more) than nine species of *Tortricidæ*, namely : *Tortrix rosaceana*, Har. *T. furvana*, Rob. *T. incertana*, Clem. *T. albicomana*, Clem. (a very distinct and constant variety of this variable species, distinguished by Zeller as "var. B.") *T. flavidana*, Clem. *Cenopis reticulatana*, Clem. *Penthina nimbatana*, Clem. *Eudemis botrana*, Schiff., and, lastly, the species of which I now propose to give an account, under the popular name of the "Rose Leaf-tyer"—the only one of all the species enumerated that seems to be confined to the Rose.

About the time that the leaves of the roses put forth in the spring, a considerable proportion will be found with the tips blackened and tightly webbed together with glistening white silk. If one of these diseased shoots be carefully pulled apart a minute larva will be disclosed eating into the heart of the growing-point, not only blackening and distorting the young leaves, but, in most cases, destroying the incipient flower bud. This insect is occasionally so abundant in the locality from which I write, as to devour or mar fully twenty per cent. of the buds, especially of white or light colored varieties. There are at least three successive broods of this Leaf-tyer during the season, but the later broods, attacking plants that are in full leaf and after the June roses are out of bloom, are not conspicuously destructive.

The larva is, when full grown, about half an inch in length, as thick as a medium-sized knitting-needle and of a glossy, dark green color. When ready to change it deserts the mass of webbed leaves within which it fed, and constructs for its protection a neat case, by slitting the blade of a leaf, on both sides, a little below the tip, and folding and fastening the partially severed portion by the edges, with the upper surface inside. This is lined with a web of white silk and within this dainty domicil the insect transforms to pupa. The latter is of slender oval form, polished mahogany brown color, and having the abdominal joints provided with rows of minute teeth, by which it is enabled to work its way out of its case when ready to give forth the moth. The moth, which issues in about ten days after the change to pupa, is a dark but handsome species, expanding rather more than half an inch. The ground-color of the front wings is chocolate brown and this is profusely ornamented with an intricate pattern in dark metallic blue. The hind wings and body are grayish-brown with a silky lustre. This pretty species is rarely attracted to the light at night; but may occasionally be observed, in the day time, resting on the plants it affects. It is preyed upon, in the larva state, by hunting spiders and by several hymenopterous parasites.

The only practicable remedy is to keep close watch for the first appearance of the larvæ in the spring, and kill them by pinching between the thumb and finger each little tuft of webbed leaves that may be discovered. This, if done in time, will prevent the destruction of the flower bud. Prof. Fernald of Orono, Maine—who is making a specialty of our N. A. *Tortricidæ*, and to whose kindness I am indebted for the generic determination of this as well as of many other species—informs me that he found a single specimen of it in the collection of the late Mr. Robinson, labelled *atropurpurana*. No notes relating to it, however, were discovered, nor has any description—so far as Prof. Fernald has been able to ascertain—ever been

published. I have, therefore, taken the liberty of setting aside Mr. Robinson's name in favor of the shorter and equally appropriate one of *cyanana*. I append a more detailed description of the species.

Larva. Length 0.50 inch, diameter 0.10, cylindrical, tapering slightly in both directions from middle, but most posteriorly; color dark green, surface glossy with two shallow wrinkles to each segment, spots minute, blister-like, each giving rise to a fine short hair. A dark vesicular line extends along the dorsum, and on each side below the small dark stigmata, is a pale translucent ridge or fold, bearing an irregular row of light hairs more conspicuous here than elsewhere. Head polished, honey-yellow inclining to olive, with a few scattered hairs, palpi white, tipped with crimson. Cervical shield polished, nearly same color as the head, covering top of segment 1. Terminal point of thoracic legs black. Prolegs concolorous with general surface.

Pupa—enclosed in a pouch-like case formed from a portion of a leaf folded over and lined with silk—elongate oval in form, very pointed posteriorly and of a bright brown color. Each of the abdominal segments is provided with two transverse rows of teeth, the posterior ridge composed of minute, close-set, rasp-like points, while those composing the anterior ridge are longer and more scattered.

In disclosing the moth the chrysalis protrudes itself from its case for nearly its entire length, holding itself in position by the anal hooks.

Imago—Alar expanse from 0.50 to 0.55. Length 0.22. Head and palpi densely tufted, brown with a slight purplish reflection, eyes grayish blue, antennæ short. Thorax with a brown dorsal tuft and dark blue patagia. Abdomen fuscous shading to brown above with a silky lustre; front and middle legs fuscous inclining to cinereous, hind legs silvery cinereous, tarsi annulated with pale buff. *Front wings* dark chocolate-brown and metallic blue; the latter color predominates in the basal third, but is interrupted about midway by an irregular fascia and some scattered flecks of brown; middle portion of the wing mainly brown, but penetrated from both apical and basal sides with streaks and points of blue; on the outer third the blue and brown colors are thoroughly intermixed in a somewhat intricate pattern, the apex being brown variegated with four or five irregular, blue spots, while the inner angle is occupied by a large oblong blue spot divided by an oblique, narrow, brown stripe. The costa presents in a strong light a succession of broad and narrow blue streaks on a purplish-brown ground and on the outer edge is a narrow border of the latter color, while the fringe is of a more or less intense blue. *Hind wings* fuscous, shading to cinereous at base, with a silky lustre, fringe cinereous. Under surface of both front and hind wings fuscous, the former a shade darker than the latter and displaying a faint iridescence. No sexual differences except the smaller size, the relatively narrower abdomen, and conspicuous anal tuft of the male.

In the article on the hibernation of the Cotton Worm published in the present number and taken from a forthcoming Bulletin of the U. S. E. C., allusion is repeatedly made to the Southern and Northern portion of the cotton belt. This division is explained in the Introduction to said Bulletin and is made to separate the hibernating and non-hibernating portions. The former, or that we term the Southern portion, may, in a general way and so far as present knowledge permits, be defined as follows: In Texas it embraces that portion of the cotton belt lying south of a line roughly indicated by the Galveston, Harrisburg and San Antonio railroad, excluding, however, the extreme western portion and extending somewhat farther north along the river bottoms. Farther east it includes the bottom lands of the Mississippi River, and its tributaries, with its northern limit unknown; then all south of and including what is known as the Cane-break region of Alabama; then the south-western corner of Georgia, and the whole extent of the Florida cotton district; and, finally, the Sea Islands of Georgia and South Carolina.

Of the interesting *Trichopsenius depressus* Lec. (tribe *Tachyporini*; family *Staphylinidæ*) only a single specimen from Georgia was hitherto known, and nothing of its habits is recorded. Mr. E. A. Schwarz, while in South Texas, found that this species is inquilinous in the galleries of the common White ant (*Termes flavipes*). In the same colony of *Termes* three undescribed and very remarkable *Aleocharini* were found.

ENTOMOLOGY IN AMERICA IN 1879.

Address of President J. A. Lintner, at the late meeting of the Entomological Club of the A. A. A. S.

GENTLEMEN :—

In the remarks which I presented to the Club at our last annual meeting, a brief review was given of the progress in American Entomology within the preceding half century. It was shown that within the last few years rapid progress had been made ; that the study of insects had enlisted the labors of many earnest and successful workers, and given to them names honored in science both at home and abroad ; that many large and valuable collections had been accumulated—several of which contained so large a number of types that their preservation in the future was a matter demanding serious consideration ; that the literature had become quite extensive ; that much had been done in working out the life-histories of our species and presenting them to the public in their economic relations ; and finally, that the importance of the study had at last been recognized here, as long ago it had been in Europe, by a Commission appointed by our General Government for the investigation of some of the insect pests which were the occasion of serious pecuniary loss, poverty, and almost starvation in some portions of our country.

It affords me pleasure to be able to report, that the past year has shown no diminution of interest or activity in our department, but that work in it is being prosecuted with an energy and with results fully up to any other department of Natural Science, if we except those to which Congress and several of our States are extending their liberal aid.

If fewer new species have been described during the year, we may find encouragement in the explanation that we are approaching the period, if not already reached, when a new species may not be claimed as the reward of every entomological excursion. And indeed, there does not seem to be urgent need of descriptions of forms so very far in advance of some degree of knowledge of transformations, habits and relations to the vegetable world.

An evidence of increasing interest is to be found in the frequent inquiries made for instructions in collecting, apparatus for preparation, and books for study. While the first two requests can be promptly met, not so with the last. We are unable to place in the hands of the student the volumes which he requires for naming his collections. This cannot but be the occasion of discouragement to the beginner, and often the cause of diversion of earnest labor to other departments of natural history. A great need of our science at the present is, monographs of the families prepared by specialists, in which descriptions of all the species shall be given (not simply referred to), and accompanied by such synoptical tables and illustrations as will enable the student readily to ascertain the names of any species which has been described.

At our last meeting I stated to you that the names of 281 persons are recorded in the last edition of the Naturalists' Directory who are making Entomology their study in North America, and that it was probable that a full list would extend the number to at least 350. It now appears that half the truth was not told. A list kept by the Secretary of the Cambridge Entomological Club, published in Psyche, vol. ii. p. 9 of Advertiser, accompanying the numbers for Sept.-Dec., 1878, contained at the close of last year the names of 762 Entomolgists in the United States and Dominion of Canada. I am informed by the Secretary that the list at the present time, without having been subjected to a critical revision, contains 835 names.

As a record of the current literature of any science is virtually a record of the progress of that science, may I ask your attention to a brief notice of some of the publications of the year following our St. Louis meeting.

A work that might serve as a model in the illustration of insects in their relations to the plants upon which they feed or frequent, is one of the unique series by Mr.

Glover of *Manuscript Notes from My Journal*, entitled, "Cotton, and the principal Insects frequenting or injuring the plant." In its twenty-two quarto plates, engraved on copper, is shown the cotton plant in every stage of development from the seed to the mature plant, and in its various conditions as resulting from insect attack or from disease. In association with these figures, twenty-four insects frequenting the plant are represented. Several of the species are illustrated in an agreeable prodigality, giving enlarged views of the egg, the larva at different stages of growth, the pupa, the cocoon, the perfect insect at rest and in flight, its under surface, enlargements of parts, and the more marked varieties of the larva and the imago. Although not so stated, it is believed that the edition of these Notes was no larger than the others of the series, and consequently, that only about fifty societies and individuals have been the fortunate recipients of a copy.

The Natural History of the Agricultural Ant of Texas is a volume of 208 pages and 24 plates, by H. C. McCook, treating at length of the habits, structure and architecture of this interesting insect. The histological details have been worked out from preparations made by Prof. J. G. Hunt.

A volume, upon which Baron Osten Sacken has been for a long time engaged, has recently been completed and published by the Smithsonian Institution. The *Catalogue of the Diptera of North America* prepared by this author and published in 1858 was simply a compilation of published names, not claiming synonymic accuracy. It contained 1,800 species, but many of the number were too imperfectly described for identification. The new Catalogue is of such merit as to deserve more than a passing mention. It is fully up to, and in itself materially advances, our knowledge of the Diptera of our country. Its author modestly regards it as only critical in part—so far as the families have been worked out into monographs, and as still remaining a mere list of reference to earlier writers, in those families which have not been studied, or in which the existing collections are to a great extent still unnamed, as in the *Culicidæ*, *Chironomidæ*, *Conopidæ*, the group of *Muscidæ calypteræ*, and the section *Asilina*. Its critical character may be seen from the statement, that of the 102 species of *Tabanus* enumerated in the old Catalogue, only 36 have been adopted in this.

An admirable feature of this Catalogue is that a large proportion of the species which it records—over 2,000 carefully described and authoritatively labelled species—are contained in the Collections of the Museum of Comparative Zoology at Cambridge, where every possible care is given to them, and where they are accessible to the student for comparison and study. Most of these are types of Loew and Osten Sacken, or their determinations.

The remarks of the author on synonymy, nomenclature and priority, seem to me to be most excellent and worthy of serious consideration. In an extended discussion of the merits of the descriptions of Diptera of the late Mr. Walker of the British Museum, he characterizes them as so extremely superficial—descriptive rather of the specimen than of the species, that in his opinion, they should be entitled to no claim for priority whenever they cannot be positively identified without an examination of the type specimen. Thus, of twenty-six species of Dolichopus described by him, not a single one could be recognized. The question suggests itself, to what extent might this rule be extended to descriptions in the other order of insects by this author, and in general, to the writings of other authors.

In considering the number of Diptera, Osten Sacken believes, that rejecting those descriptions which will probably prove irrecognizable, the number of described Diptera of North America, north of Mexico, will hardly reach 2,500; that the undescribed material at present in collections, if worked up, would perhaps double the number; and that when the long neglected order shall have received the attention

given to the Coleoptera, it will equal if not exceed the latter, numerically.

Reference at the present to studies in the Diptera, naturally suggests the great loss which Dipterology has sustained in the recent death—in April last—of the distinguished Prussian Dipterist, Dr. H. Loew, long known as one of the most eminent cultivators of this branch of Entomology. During the last twenty years he has been engaged in the study of North American Diptera, and at the request of the Smithsonian Institution he has prepared a series of monographs, three volumes of which (Parts i., ii. and iv.) have been published by that Institution. While his removal from his work at this stage of its progress, cannot but be deeply deplored, there is a consolation to be found in the knowledge that it is not to be wholly arrested, but that a worthy collaborator—Baron Osten Sacken—remains to conduct it to a completion, we hope, of the plan proposed.

The series of *Dimmock's Special Bibliographies*, now being published at Cambridge, Mass., will prove to be of eminent service to the student who desires to avail himself of the literature of our insects, so widely scattered through the various scientific and popular journals, government surveys, and other publications. Two numbers of the series have been issued—the first containing a complete list to date, it is believed, of the Entomological writings of Dr. John L. LeConte, and the second, those of Dr. George H. Horn. A third, of the writings of Mr. S. H. Scudder, is nearly completed. I regret that it has been thought necessary, in this series, to dispense wholly with the use of capitals in all scientific names, even in the family and ordinal divisions, and I believe that many of you will agree with me in claiming for the royalty of science exemption from conformity to an innovation based on mere convenience.

Prof. C. V. Riley and J. Monell have contributed to the Bulletin of the U. S. Geolog.-Geograph. Survey (vol. v., pp. 1-32) a paper entitled *Notes of the Aphididæ of the United States, with Descriptions of Species occuring West of the Missisippi.* Part I contains extended biological notes on the Pemphiginæ, by Prof. Riley, and Part II, notes on Aphidinæ with descriptions of new species, by Mr. Monell. The paper, illustrated by two plates, is a valuable contribution to our knowledge of these exceedingly interesting insects.

A special Report from the Department of Agriculture, entitled, *The Silkworm: being a brief Manual of Instruction for the Production of Silk*, has been prepared by Prof. Riley, and largely distributed by the Department, to meet the demand from various portions of the United States for information upon the important industry of silk culture. The Manual is quite full in the natural history of the Silkworm, in the methods of culture, and directions for reeling cocoons. There seems no reason why this industry, properly fostered, may not be made to add materially to the productive resources of our country.

Abstracts of the papers presented by Prof. Riley at the St. Louis meeting of the American Association for the Advancement of Science, have been published in the Proceedings of the Society, and also in a separate pamphlet. Among these are *Notes on the Life-history of the Blister-beetles and on the Structure and Development of Hornia; On the Larval Characteristics of Corydalus and Chauliodes*, and *A New Source of Wealth to the United States* [Sericulture].

A Century of Orthoptera, commenced by Mr. S. H. Scudder in 1868, and continued at intervals in vols. 12–20 of Proc. Bost. Soc. Nat. Hist., has been completed during the present year by the publication of the last three decades, in vol. 20, op. cit. The species described pertain to the Gryllides, Locustariæ, Acridii and Forficulariæ. The several parts as originally published have been reprinted in a pamphlet of 48 pages. Mr. Scudder has also published (Psyche, vol. ii., p. 154) a short list of Orthoptera collected in Appalachicola.

Entomological Notes, No. vi., by Mr. Scudder, issued the past year, is mainly a

reprint of papers upon the Orthoptera originally published in the preceding year. The accompanying index furnishes a ready means of reference to the species contained in the several papers.

In the Annual Report of the Chief of Engineers for 1878, Prof. Cyrus Thomas reports upon a small collection of Orthoptera made in the Explorations and Surveys of the San Juan region of Colorado. The same volume contains a report by Mr. H. Strecker, on Hymenoptera, Lepidoptera and Coleoptera from the same region, in which several new species of Heterocera are described, and a few figured.

Of our Entomological serials, the *Canadian Entomologist* continues to sustain its high reputation, and to merit the contributory aid which it is receiving from nearly all of our American Entomologists, and from some of our European friends.

Psyche, the organ of the Cambridge Entomological Club, is near the completion of its second volume. With the commencement of its third volume such improvements are promised as will render it of still higher importance to every student of American Entomological literature.

The *Transactions of the American Entomological Society* have reached the seventh volume. Although the Society has become a section of the Academy of Natural Sciences of Philadelphia, it is proposed to continue the publication of the Transactions as at present as rapidly as the limited means available for the purpose will permit.

The *Bulletin of the Brooklyn Entomological Society* is continued. That of the Long Island Scciety has been discontinued.

The second volume of the *Butterflies of North America*, by Mr. W. H. Edwards, is in course of publication. It continues to maintain the high reputation which it has commanded, from its admirable delineations of forms and coloring, and the exceedingly interesting new biological details presented.

The North American Entomologist is a new candidate for favor and support, of which two numbers have appeared. It is a monthly periodical, published at Buffalo, N. Y., under the editorial charge of A. R. Grote. It purposes to present articles of value both to the specialist and the agriculturist on the subject of North American insects, together with notices of current entomological literature.

Descriptions of the Noctuidæ have been continued by Prof A. R. Grote in contributions to the *Canadian Entomologist* and in the *North American Entomologist.* With a diminution in the number of new forms of Noctuæ presenting themselves, Mr. Grote has directed his attention to the Pyralidæ, and has published a paper in the Bull. U. S. Geolog.-Geograph. Survey (vol. iv., pp. 669-705), entitled, *A Preliminary Study of the North American Pyralidæ*, in which a number of new species are described, the species of Botis enumerated, and the venation given of certain genera of the Phycidæ. A supplement to this paper follows in the *North American Entomologist*, No. 2, pp. 9–12.

[*To be continued.*]

[From the Pacific Rural Press.]

THE MISSION GRAPE AND THE PHYLLOXERA.

Editors Press:—It is asserted by some who ought to know, that the Mission grape is not liable to be destroyed by the Phylloxera. I should like to enquire through the columns of the Press whether there is truth in the assertion. Will some one give us his experience?—W. R. Barbour, Orange, Cal.

Editors Press:—According to all accounts, and observations made by himself in the Sonoma valley, the Mission grape is at least as liable to the Phylloxera as any of the more hardy varieties of the foreign grapes, and falls an easy victim to the pest. The impression conveyed to your correspondent may have originated in the statement that the native California grape is exempt from the ravages of the Phylloxera. But this refers to the wild grape of the banks of our streams, and of this the statement is most probably true. It is, of course, well understood that the Mission vine, though now growing wild in some regions, is an imported European plant.

I hope that those who, in timely foresight of the inevitable, propose to graft

their new vineyards on phylloxera-proof stock, will test the resistance of the wild vine before investing too heavily in the importation of "Taylor." It would be very handy to be able to get their cuttings on the nearest creek bank; and from specific peculiarities of the wild vine, I have very little doubt that it is really proof against the pest.—E. W. HILGARD, University of California, Nov. 25th.

LARGE WHITE SCALE ON ACACIAS, ETC.

The large white scale insect which was first announced from San Rafael as destroying the acacia trees and then spreading to other trees and plants, has been determined by Prof. C. V. Riley to be a species of *Dorthesia*, an abnormal bark-louse of the family *Coccidæ*. Prof. Riley determined it from specimens sent him by Dr. Saxe of Santa Clara, where it has also done much damage. Prof. Riley says: "It is an Australian insect (apparently *Dorthesia characias* Westw.), and has of late been introduced to Australian plants into South Africa, where it has multiplied at a terrible rate, and become such a scourge as to attract the attention of the government." He anticipates much trouble from it also in this State, because it is free here from the natural enemies which keep it in check in its own country. Those who are not familiar with this scale insect may recognize it from its snowy white color, and its growing nearly as large as a coffee berry. The upper surface of the scale is beautifully ribbed.

The German Society of Railway Companies has lately been discussing the best method of preventing the ravages of moths in the cushions of railway carriages, and has invited responses to a circular asking for information as to successful treatment on the part of its directors. Collating the replies, it is found that the best methods are constant cleaning, airing, and beating (especially in the critical period toward the end of May), the avoidance of any fold in the cloth used, Persian insect powder, beating of the cushions in dry air, use of plush instead of woolen cloth, avoidance of sheep's wool, and the introduction of sea-weed for stuffing instead of horse-hair. The most important of all, however, is the frequent beating and exposing to fresh air.

DRAGON-FLIES AND TELEGRAPH WIRES.—Small Libellutæ hold a daily parade upon the telegraph wire. I noticed them upon my way from Geneva; and since then a Frenchman (ignorant of entomology) was so struck by their singular appearance that he called my attention to them. When one chances to catch a fly it returns to the wire to eat it (the fly, not the wire).—*A. E. Eaton, in Entomologists' Monthly Mag.*, (London), *Sept.* 1879.

The Grape Phylloxera is reported in a recent number of *Nature* as occurring in the district of Geelong, Victoria.

IMPORTANCE OF ENTOMOLOGY TO THE FRUIT-GROWER.

That veteran pomologist, Marshall P. Wilder, thus discourses in one of the many admirable addresses which he has delivered as President of the American Pomological Society:

The subject of insects and diseases is daily attracting more attention, for their depredations are daily becoming a greater evil, and the importance of entomological investigation is every day more plainly seen. It is less than fifty years since Dr. Harris first published his work on "Insects injurious to vegetation," and great is the debt of gratitude which we owe to him and the succeeding investigators who have given their lives to studying the habits of these little "creeping things which be upon the earth," that they may teach us how to destroy those which prey upon our trees, and so distinguish our friends from our foes. Every plant imported from abroad brings with it a new insect or disease, and the dissemination of new plants and varieties without which there can be no progress in horticulture, inevitably disseminates their insect enemies. On this subject the words of Edmund Burke are appropriate: "The most vigilant superintendence, the most prompt activity which has no such day as to-morrow in its calendar, are necessary to the farmer," and we

may add, still more to the fruit-grower, and tenfold more necessary in combating our insect enemies; but as long as moral evil exists in the world, so long may we expect there will be evil in the natural world, and he who is not willing to contend against both, is not worthy of the name either of cultivator or of christian.

HESSIAN FLY NOTES.—"My opinion," says Mr. George A. Green, in the New York Tribune, "is that we have not yet gone far enough with our experiments to recommend a farmer to borrow money for the purchase of phosphate. It is claimed by some of our best farmers that the Hessian fly, which has been very destructive this season, does not work so disasterously in fields fertilized with phosphate. My observations have shown that where any fertilizer has been used liberally, this insect has done less mischief.

At a late meeting of the Elmira (N. Y.) Farmers' Club, the following discussion took place relative to early and late planting. W. A. Armstrong said: There were hundreds of wheat fields ruined by the fly last year, and with its presence this year there would be similar loss. Late sowing appears to be the only way to prevent the fly from continuing its depredations. The rule is to wait until after a killing frost before sowing the seed. The fly lays its eggs on the wheat-leaves in the fall, they hatch there if the weather is suitable, the larvæ descend to the roots of the plants, and in the following spring develop into flies that lay eggs to hatch in turn, but the larvæ burrow in the stalks above the first joint usually, and arrest the ascending sap, thus destroying the crop. Now with all these conditions met, this course would be repeated year after year, and wheat raising would be attended with loss. Last fall there was general apprehension that the fly would destroy the crop this year, so a new condition was provided to prevent its work. After a severe frost it does not deposit eggs, or if eggs are laid they will not hatch. So most farmers sowed later than usual, and if they have poor crops there is compensation in the fact that they are rid of the fly, and they may console themseves farther by the reflection that a poor crop is better than no crop, which would be the certain result of the fly's continuance.

G. S. McCann—I don't believe in late sowing—fly or no fly. Early-sowed wheat is always better. In my judgment the recommendation to sow late has cost our farmers thousands of bushels of wheat. Wherever you find a good yield of wheat this year you may find also that the seed was sowed early.

Col. Piollet—What do you call late sowing?

G. S. McCann—Seed sown in October is late. I prefer the last week in August. If I might set a limit of time, I would never sow later than the fifth of September, and with other chances equal, I should never fail to get greater crops than my neighbors who adopt the practice of late sowing. Even when the fly is troublesome, fuller success will attend early sowing. I know this is true by my own observation.

ABNORMAL PREVALENCE OF BLOW-FLIES.—The following account of an unexampled prevalence of blow-flies is by an intelligent writer in DeBow's Industrial Resources of the Southern and Western States, Vol. I, 1852. The account doubtless refers to the smaller blue fly (*Lucilia macellaria* L.) which appears to be the parent of the dreaded "Screw Worm," and not to any of the commoner and larger blow-flies, as *Lucilia cæsar* L., etc.:

"About eighteen years ago the *green* or *blow-fly* became so numerous that thousands of animals perished by them, as also some human beings. The least spot of blood, the moisture of the mouth, eyes or nose, was sufficient to cause a deposit of eggs. Sick persons, particularly those who had not proper attention, suffered. Several negro children who came under my notice, fell a sacrifice to them, and it was with difficulty that many others were saved. In these instances the fly deposited the eggs within the nostrils, where they soon caused death by producing inflammation of the brain. This fly is annual, and scarcely

ever deposits its eggs on an animal, except it be the victim of a running sore; but at the period alluded to above, it appeared that there was scarcely animal food enough to feed the maggots of this numerous host. It is but once within my recollection that I have witnessed this phenomenon, and neither before nor since have I heard of such ravages of the green fly. Why they should have existed in such incredible numbers at the time referred to is a question not to be easily answered."

EXTRACTS FROM CORRESPONDENCE.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

A NEW CABBAGE WORM.

I have something new. It is a new Cabbage worm, the larva of *Pionea* [*Orobena*] *rimosalis* Guen., which appeared late the past season, remaining on the cabbages till toward the end of November. It is very destructive, doing as much injury to my cabbages after it appeared as the imported Cabbage worm (*Pieris rapæ*) which has been very destructive here this season. The larva, when full grown, is six- or seven-tenths of an inch long (a 16-legged Pyralid larva); slender, slightly flattened; head shining greenish-yellow; dorsal portion of the body down to the breathing pores purplish-brown; this portion marked with numerous transverse whitish lines, two or three to a segment; a narrow, pale yellow line along the region of the stigmata; underside pale green. In the breeding cages they went down to the soil, but not into it, to pupate; forming a slight, regularly shaped, oval cocoon, thickly covered over with sand.

Miss Middleton's record shows as follows: "Went into the pupa state September 12th, 13th, and 14th; moths appeared 16th to 22d, and on to Oct. 1st."

After this there was another brood of worms, my description having been taken from living specimens, Nov. 21st.

The eggs I have not seen, but from the fact that the young feed somewhat together (though not really in companies) I presume a number are laid together.

These worms eat, as a general thing, elongate oval holes in the leaves, gradually extending them until nothing but the larger veins remain.

They also bore directly into the heads, to the depth of, or rather through three or four leaves; a habit, so far as my experience goes, wrongly ascribed to the larva of *P. rapæ*, which will seldom eat through even one leaf of a solid head until it is at least slightly loosened.

Lime, ashes, brine, salt, elder decoction and lye as strong as the cabbages can bear, and other substances tried, have even less effect upon them than on the imported cabbage worm. The lye, fresh made, of strong ashes, did more good than anything else tried.

I have ascertained that some varieties of the cabbage suffer much less from *P. rapæ* than others, and that bringing them forward two or three weeks earlier than usual so as to have the heads pretty well formed before full brood appears, is also an excellent plan to counteract them.

CYRUS THOMAS, Carbondale, Ill.

[This is the first instance which has come to our knowledge, of *Pionea rimosalis* injuring cabbage. It is interesting, as illustrating the unity of habit in the genus which essentially feeds on *Cruciferæ*. The larva *P. forficalis* L., is very destructive to cabbages in Europe, working very much as Prof. Thomas has described in the case of *rimosalis*.—*Ed.*]

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Borers in Black Ash—Fall Web Worm—Apple Tree Insects—I have this day expressed a box of Black Ash wood and the worms found therein. [1.] Also a tent of leaf-worm that has long infested the Ash of western New York. They have sometimes been so numerous as to defoliate trees before autumn. [2.] The enclosed apples show marks of the so-called gimlet-worm, which attacks full grown apples. It is quite distinct from the Codling Moth; is a comparative new-comer, and is fast increasing. [3.] The small

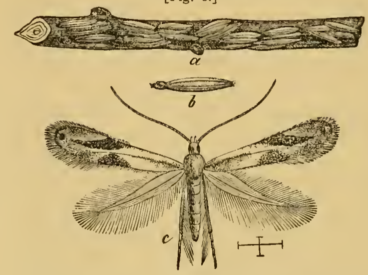
box contains eggs of an orchard insect first observed here last year. They are deposited on the bark near the forks, and number from two to twenty per tree. I called attention to them at the last winter meeting of the Western New York Horticultural Society; but one member had observed them. They are deposited in early autumn to hatch in spring, but this fall has been so exceptionally warm up to date that you will see that many of the eggs have hatched. I have not seen or recognized the matured insect. What are they, friend or foe? [4.]

Scottsville, N. Y. SHELBY REED.

[1.] The borer that so badly affects the roots, and which is reported to be absolutely killing out the Black Ash trees in parts of New York, belongs to the *Cerambycidæ* or long-horned beetles. The species cannot, however, be determined until it is reared to the perfect state, as none of the writers on the insects of New York mention any beetle larva thus affecting this tree. The only ash-borer mentioned by entomologists is a Lepidopterous insect (*Trochilium dennudatum*). [2.] The webs or tents so common upon that tree are those of the Fall web-worm (*Hyphantria textor*); it is also prevalent on many other kinds of trees. It has been particularly abundant in New York State the present year. [3.] We found nothing in the apples sent but a dead specimen of the ordinary apple-worm (*Carpocapsa pomonella*). We shall be glad, therefore, to get other bored apples, so as to learn the real nature of what you call the "gimlet worm." [4.] The supposed eggs upon the bark of your orchard trees are in reality the cocoons of the Apple-leaf Bucculatrix (*Bucculatrix pomofoliella* Clemens). It is found upon apple trees in most of the States where apples are grown.

The little worm that spins these cocoons feeds externally on the leaf, being quite active, and letting itself down by a web when disturbed. It measures about one-half inch in length when full-grown, and is of a dark green color, with the joints of the body swollen so as to look like a series of beads. The principal damage is done in the month of September. The pupa, which is of a dark brown color, works its way partly out of the cocoon and gives forth the moth in spring. The female moth at once lays her eggs on the tender leaves, the worms which hatch therefrom spinning up in midsummer. There are, therefore, two annual broods. As stated in the fourth Report on the Insects of Missouri, the great peculiarity of this insect is its habit of forming its little ribbed cocoon in company on the bark—a habit which at once gives us the mastery over it; for as the pupa remains in the cocoon all through the winter, we can make war upon it at any time during that season. When the insect is abundant these cocoons will absolutely cover the smaller twigs in the manner shown in the accompanying figure, and they will be found even on the larger branches and trunk. Anything applied to the tree with the object of killing these pupæ must be of an oily nature, so as to readily soak through the cocoon. We have experimentally proved that an application of kerosene oil is death to them, and though we have had no opportunity of testing it on an extensive scale, we have no hesitancy in advising its use, or that of linseed

[Fig. 6.]



APPLE-LEAF BUCCULATRIX.—*a*, twig covered with cocoons; *b*, cocoon enlarged; *c*, moth enlarged; nat. size in hair-line (after Riley).

oil. Alkalies might also be tried. The best time to apply the remedy in your locality is April, and we advise no delay beyond that month, as the moths begin to issue soon after tree-growth actively recommences. Apply the kerosene in diluted form by stirring in hot soap-suds, and spraying upon the trees by means of a force-pump and atomizer—the tree, if badly infested, to be first vigorously pruned.—C. V. R. in *Land and Home*.

Skippers injuring smoked Hams.—The smoked hams cured in Peoria suffer much from the ravages of the enclosed insect. One firm lost over two thousand dollars from this cause last year. When the hams are taken from the pickle and smoked, they are hung in a two-story room and left forty-eight hours in a smoke of sawdust. This is during July and August. During this time the fire must be replenished, and by opening the door a strong current of air is formed, which it is thought forces the flies in the smoke-house, and the eggs are laid at that time. When they are taken from the smoke-house it is after night and in a dimly lighted room, only enough are taken out to supply the men employed to cover them with paper and canvas. This is quickly done, and then the whole covering of the ham is immersed in a solution of what they call yellow glue. The seams are very firmly fastened and glued, the two thicknesses being ample protection; but when many of the bags are opened they present a loathsome sight. The animal is killed in cold weather and the hams remain under brine until smoked. Can you suggest any thing as a remedy? Do you believe the eggs are laid in the smoke-house or the flies encased in the hams? The distilleries are in the neighborhood, and perhaps cause a greater number of flies. E. A. S., Peoria, Ills.

The insect in question is what is properly known as the "Skipper," (*Piophila casei* L.)

which is so injurious to cheese. It is one of the "Blow flies" which we speak of in an article on the Red-legged Ham-beetle (Sixth Mo. Ent. Report, p. 100) and is quite injurious to hams in St. Louis also, where we have proved its identity with the Cheese Skipper. It is more than probable that the suggestion which we made to the Messrs Whittaker, namely, to use a stronger and heavier canvas, and to get all the canvasing done before the first of May, would, if acted upon in the present case, serve to protect the hams from this "Skipper" as well as from the *Corynetes* treated of in the above named article. There is little doubt but that the eggs are laid in the storing house, on exposed places after the bagging is done, while the distilleries in the neighborhood can have no effect in increasing the injury, because the species does not breed, so far as we know, in anything about a distillery.

Tipula Eggs in the Stomach of the Cat-bird.—I send you by express, (1) the eggs (?) from the stomach of a Cat-bird ; (2) also other eggs (?) from the stomach of the same species. I write with an interrogation, because, although I found that the contents of the coreaceous flexible shells were such as we should expect from an egg, and gave the proper reaction with iodine and sulphuric acid, when I sent them to Dr. Hagen for identification, he reported them to be the "seeds of some plant." As he does not wish to make identifications for persons at a distance, I think he gave them too hurried an examination. You will easily satisfy yourself, however, on this point. The first I refer to are black, oval, smooth, and deeply concave on one side. The other, longer eggs, have occured each time associated with them. Ants are the only other element common to all the stomachs in which these eggs are found.

S. A. F., Normal, Ills.

A glance at the contents of the bird's stomach sent by our correspondent shows that (1) the highly polished, ebony black bodies, 0.8 *mm.* long and 0.4 *mm.* wide in the middle, and looking like miniature boats, being elongate-ovoid, rather pointed at each end and flattened and somewhat concave on one side, are the eggs of some species of Crane-fly (*Tipula*) ; while (2) the more elongate coriaceous yellowish objects are the valves of the female ovipositor. The particular species could be ascertained by the wings or such fragments thereof as are obtainable, together with the male genitalia. Judging from the valves of the ovipositor referred to, one of the species will prove to be *Tipula trivittata* Say. We have on several occasions witnessed the laying of these eggs, with which the female abdomen is literally crowded, when gravid, to the number of about 300. The eggs are forced in the ground by means of the double pair of valves, something as in the case of our common locusts ; but they are so readily and rapidly extruded, in confinement, as to have led some authors to believe that they are dropped while the parent is flying.

DESCRIPTIVE DEPARTMENT.

NOTICE OF THREE NEW HYMENOPTEROUS PARASITES.

BY E. T. CRESSON, OF PHILADELPHIA, PA.

Anisopelma lycti.—♀. Honey-yellow, shining ; head sub-globose, cheeks paler than remainder of head ; tips of mandibles black ; eyes cinereous ; antennæ two-thirds the length of body, setaceous, fuscous, pale at base ; mesothorax prominently trilobed, anterior lobe transverse, divided by a feebly impressed longitudinal line ; disk of mesothorax depressed and rugose ; metathorax rounded, subobsoletely reticulated ; wings hyaline, iridescent, nervures and stigma fuscous, the latter conspicuous ; legs, including coxæ, entirely luteous ; abdomen longer than head and thorax, almost sessile, depressed at base, convex and polished beyond middle of second segment, the first and basal half of second segments longitudinally aciculated ; ovipositor nearly as long as the body, luteous, tipped with black ; the sheaths dull luteous, with the apical third blackish. Length .12 inch.

♂. Head, mesothorax, scutellum and apical margin of the second and following segments of abdomen piceous or fuscous ; mouth parts, lower portion of cheeks, pleura and metathorax dull honey-yellow ; eyes, antennæ and wings as in ♀ ; legs and base of abdomen luteous-yellow ; first and base of second segments feebly aciculated. Length .06 inch.

Received from Mr. Howard M. DuBois, as parasitic on the larva of *Lyctus striatus* Say, or "Powder-post worm," an insect destructive to hickory timber, a full account of which is given by by Mr. DuBois in "The Hub" for October 1, 1879.

Anisopelma utilis.—♀. Honey-yellow, shining ; vertex, eyes, mesothorax and scutellum blackish ; head subglobose ; antennæ nearly as long as the body, setaceous, slightly thickened at tips, fuscous, paler at base and beneath ; mesothorax depressed and roughened on disk ; metathorax rounded and feebly sculptured ; wings hyaline, iridescent, nervures and stigma pale fuscous ; legs, with the coxæ, entirely luteous, tarsal claws black ; abdomen subsessile, depressed, oblong-ovate, first and base of second segments finely longitudinally aciculated, remainder polished, third and following segments tinged with pale piceous ; ovipositor rather longer than abdomen, blackish, basal half pale. Length .09 inch.

♂. Face and sides of pleura dusky ; cheeks, pleura beneath and metathorax dull honey-yellow ; abdomen narrower, shading into piceous at tips ; otherwise as in ♀. Length .09 inch.

Albany, N. Y. This and the following species were received from Dr. J. L. LeConte as parasitic on the larva of *Trogoxylon parallelopipedum* Mels.

Anisopelma minima.—♀. Piceous ; face, cheeks, pleura, sides of metathorax and legs, dull luteous ; head large, subglobose ; antennæ long, setaceous, pale, rather more slender at base ; metathorax rounded, roughened ; wings hyaline, iridescent, nervures and stigma pale fuscous ; abdomen subsessile, fusiform, shining, the base and extreme apex pale brownish ; ovipositor about as long as the abdomen, sheaths robust, pale, tipped with black. Length .06 inch.

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We note, from the Proceedings of the London Entomological Society, Nov. 5th, that the Oxford Commissioners propose to unite the Chair of Entomology founded by the late Rev. F. W. Hope and honored by the veteran entomologist Westwood, with a Readership in Invertebrate Zoology. It seems that the widow of Mr. Hope, before her death, protested against the change as opposed to the spirit of the bequests and the clause of the deed under which the Professorship was held. We sincerely hope, with Mr. McLachlan, that the chair may continue to be held by an entomologist, as a guarantee that the extensive collections will be properly cared for and appreciated, and made to subserve the purposes intended by the testator.

RESISTANCE OF AMERICAN VINES TO PHYLLOXERA.—The vice-president of the Horticultural and Botanical Society of Herault, M. de Lunaret, draws attention in a recent number of the *Messager du Midi*, to the fact that a downy, white-wooded *Riparia* which was planted in 1868, in ground near Montpellier owned by a M. Batigne, is still perfectly healthy, while all the neighboring vines are dead or dying.

THE 17-YEAR CICADA IN IOWA.—The data furnished by Prof. Bessey are interesting as more clearly defining the western and northern limits of our brood XIII (1878), which limits were previously unknown; also as showing more clearly than was hitherto known the western limits of our brood V (1871). There can be little question, we think, that the limits of this brood may be extended throughout the region shown by the dotted lines and that the discrepancy of a year or two in some of the locations reported, may be accounted for by accelerated or retarded development. It is very difficult to say whether or not the records for the extreme southwestern counties indicate similarly retarded appearances of the more extended brood XIII, or whether they represent our brood XIV—that for 1862–1879; but as we have given good reasons in the report already cited by Prof. Bessey for considering these two broods distinct, we think they should also be kept distinct in the State of Iowa. This conclusion is confirmed by data received subsequent to the preparation of Prof. Bessey's paper. The Cicadas were very thick in northwestern Missouri and also very abundant in Taylor and Adams counties in Iowa. We have prepared a map with a view of embodying the information communicated by Prof. Bessey, and which gives our own idea founded upon his data of the distribution of the three broods in question. By comparing this distribution of the Cicada with the distribution of timber, as shown in Plate 1 of the Iowa Weather Report for 1878 by Dr. Hinrichs, it becomes obvious that there is a relation between the two, namely that the most extended brood (XIII) occurs in the

Desmoines River Valley, the heaviest timbered portion of the State; the next brood (V) along the Mississippi River in the northeastern part of the State, and finally the third in the southwest corner of the State toward the Missouri River.

Vegetal-feeding Ground-beetles.—From the *Deutsche Entomologische Zeitschrift* (1879, p. 417) we learn that *Bembidium lampros* and *monticola* have proved injurious to forests in Upper Austria. In beds where young trees are raised and which are covered with dry twigs these beetles gnaw and destroy the young plants near the surface. In the beds not covered they do less damage. This is simply confirmatory of the exceptional plant-feeding habits of members of a family essentially carnivorous. *Zabrus gibbus* has long been charged in Europe with injuring wheat, and we have been struck lately with some original observations on the food-habits of beetles communicated by Mr. F. M. Webster to the *Prairie Farmer*. He charges certain species of the genus *Harpalus* with preying upon vegetation and more recently accuses *Anisodactylus sericeus* Harris of being particularly fond of the unripe seeds of some grasses, especially of *Poa pratensis* and *Agrostis vulgaris*. The *Amara angustata* Say he also found especially abundant on June grass. But still more interesting as corroborating the reports now coming from Germany is the statement of a Mr. Mathae of Marshaltown, Iowa, that certain grubs did serious injury to his evergreens by eating and severing the roots, which grubs were subsequently determined by Prof. Thomas as the larvæ of some species of *Harpalus*, Mr. Mathae being quoted as a careful observer.

The Pear-leaf Blister.—Prof. T. J. Burrill of the Illinois Industrial University, gives, in the January number of that excellent journal, the *Gardener's Monthly*, an account of the mite which produces a wide-spread disease of the Pear-leaf. He takes it to be identical with the *Typhlodromus pyri* of Europe, which similarly works on Pear-leaves, and he looks upon it as another of the many scourges we have introduced from Europe. It is a four-legged mite which most naturalists have assumed to be a larval form, though Prof. Burrill gives reasons for believing it a perfect form. Measuring only .005 of an inch in length it has been very generally overlooked by naturalists. There are very many of these minute creatures, belonging mostly to the genus *Phytoptus*, concerned in the leaf diseases of most of our trees and shrubs, and their habits and development offer a most interesting field for study to any one who will give them special attention.

Fuller's Rose-beetle in California.—It appears from the *Pacific Rural Press* (January 10th, 1880) that this beetle (*Aramigus Fulleri* Horn) which we have recently treated of in our report to the Department of Agriculture and which is so troublesome to our florists, is also destructive to several shrubs on the Pacific coast, among them Dracænas, Orange, Cape Jassemine and *Achyranthus*, feeding upon them outdoors. The work of the beetle only is referred to, though in the green-houses the larva does most injury by working upon the root. The species was determined by Prof. Comstock.

Lepidium vs. Bed-bugs.—S. M., by which initials we think to recognize the genial Samuel Miller of Bluffton, Missouri, refers in the *Gardener's Monthly* to the peculiar property of *Lepidium* or Pepper-grass as a Bed-bug destroyer. The *Acanthus* seems to be attracted by the plant and killed, presumably by feeding upon it. Unfortunately the particular species of *Lepidium* is not determined.

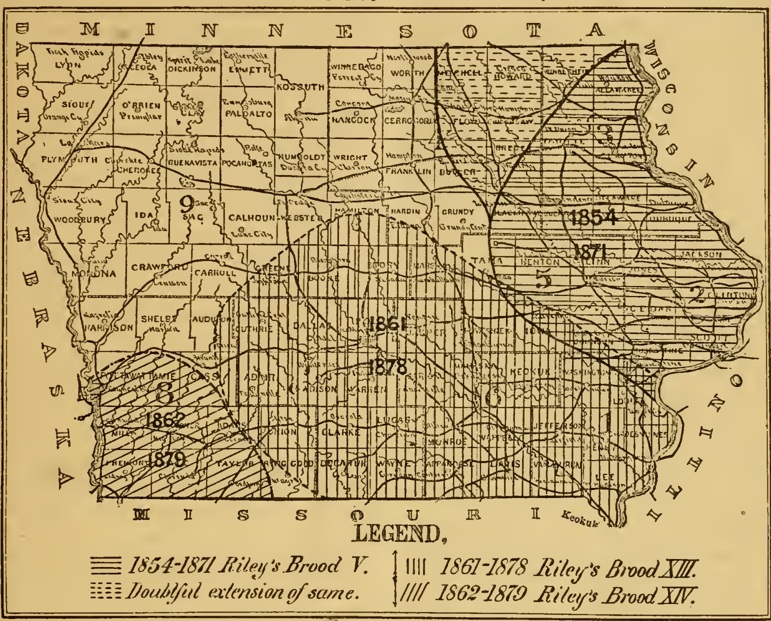
Aniseed and Grain Weevils.—The French agricultural journals report an instance where grain weevils were attracted to a tub of aniseed, all leaving the grain bin and going to the aniseed, which killed them soon after they came in contact with it.

ON THE DISTRIBUTION OF THE SEVENTEEN YEAR CICADA OF THE BROOD OF 1878, OR RILEY'S BROOD XIII, IN IOWA.

BY PROF. C. E. BESSEY, IOWA AGR. COLLEGE.

In June 1878 I sent out ninety-eight postal cards bearing the following inquiries, viz.:

[Fig. 7.]



(1) Are the Seventeen Year Locusts (*Cicada septemdecim*) abundant in your neighborhood this year? (2) Are they doing any damage? (3) When were they *known* to be in your neighborhood before this? (4) If this is not "Locust Year" with you, please to state exactly when it occurred, if known to you. There are probably some localities in which the Seventeen Year Locusts never have appeared,—please to note and investigate.

A few days later I published the same inquiries in the "College Quarterly" (a paper published by the Agricultural College, and having a wide circulation, being in fact sent to every county in the State). As a result of these inquiries I received replies from about fifty counties. In some counties where no Cicadas have ever appeared, the persons addressed apparently thought the matter of no importance, and failed to send answers.

I also made inquiry through the students of the Agricultural College and received from them some reliable information. I have in this way obtained a mass of information, the greater part of which is fully reliable. In a few cases only is there doubt as to the value of these replies.

As fast as answers were received I marked in red upon a map those counties in which the Cicadas were reported as having appeared this year: those in which they appeared in 1871 were marked in blue; while those in which they have never appeared were marked with a large circle [O]. A copy of this map accompanies this paper.

Twenty-eight counties were reported as having more or less of the Cicadas in 1878 and they are seen on the map to occupy a large area extending from the south-eastern portion of the state northwestward up the Des Moines river. This area includes several counties from which no replies have been received, but in which

doubtless the Cicadas appeared; these added to the reported counties make the whole number thirty-three or thirty-four, or, say one third of the State. A careful calculation shows this area to include from 18,000 to 20,000 square miles. Its northern, or more properly, its northeasterly margin is parallel with the Des Moines river, and distant from it about fifty miles, running from near the city of Muscatine to Hamilton Co. when it bends off southwestwardly to Cass Co. and thence to the State line in Decatur County. That part of the area lying southward, or southwestward of the Des Moines river is considerably broader than that on the northeast, being from sixty to seventy miles in width.

LIST OF COUNTIES, WITH EXTRACTS FROM CORRESPONDENCE.

VAN BUREN. (1) Yes. (2) They are not doing very much damage. (3) In 1861.

DAVIS. Information that they were in this county this year is derived from a newspaper account.

WAYNE. Abundant.

DECATUR. (1) Abundant. (3) In 1861.

DES MOINES. Rather abundant, but not to be compared with what they were in 1861.

HENRY. They are not abundant; not nearly so many as when here in 1861.

FAIRFIELD. They are not considered abundant this year. Hon. C. W. Slagle made a memorandum in June 1844 "Our groves are alive with an innumerable multitude of Locusts. I note this Locust Year." And again in June 19, 1861 "The Locusts are very numerous at present."

WAPELLO. Not abundant here, compared with the amount we had in 1861, when they did some damage to fruit trees and timber.

MONROE. Very abundant in 1861; fewer this year.

UNION. (1) They are here, but not in numbers sufficient to create any alarm. (3) In 1861.

LOUISA. (1) They are in our county this year, but are not abundant. (2) Doing little damage. (3) As near as I can learn they were here in 1861 and again about seven years ago [1871].

☞ This is interesting, as indicating an overlapping of the two broods (*i. e.* of 1871 and 1878) which occur in the State. [C. E. B.]

KEOKUK. (1) They seem to be abundant in the timber and adjacent thereto. (3) 1861.

MAHOSKA. (1) Quite abundant. (2) Not doing any damage. (3) 1861.

MARION. (1) Quite abundant in the groves of native timber. (2) Not doing as much damage as I have known them to do heretofore. (3) 1844 and 1861.

WARREN. (1) Quite abundant here, especially in the woods. (3) They were here in 1861, and were much more numerous than now.

MADISON. (1) They are in this county in considerable numbers, but not so as to be called abundant. (3) Old settlers say they were here in 1861.

ADAIR. (1) They are very few in number. (3) They were very plentiful when here in 1861.

CASS. One informant in the eastern part of this county says "They are here though in small numbers": while another in the western part reports "none at all this year."

IOWA. (1) We have them, but not abundantly. (3) We had them in 1871 in great abundance.

☞ This report, like that from Louisa Co., indicates an overlapping of broods. Another correspondent from the same part of the county reports no Cicadas this year, but refers to the brood of 1871. [C. E. B.]

POWESHICK. (1) They are here in abundance. (3) Numerous in 1861. Some years ago [1871] there were a great many, but not a tenth part as many as this year.

JASPER. (1) Quite numerous. (3) In 1861, according to old settlers.

POLK. Not near as abundant as at their last visit in 1861.

DALLAS. (1) Not abundant. (3) I have lived here twenty-five years, and do not remember ever seeing them here before.

MARSHALL. (1) They are abundant in parts of this county. When they first made their appearance, two weeks ago, they were only where there were natural groves of timber. Within a few days they are spreading out on the prairies to where there are planted groves and orchards. (3) In 1861.

STORY. (1) Abundant in certain parts of the woodlands. In one extensive piece of low woodland, none at all were observed. As there had been a great freshet a little while before the time for their appearance above ground,

probably they were drowned. (3) In 1861 according to old settlers. [C.E.B.]

BOON. A correspondent informs me that they were in this county this year.

GREENE. (1) Abundant. (3) Were here in 1861. Another correspondent says they were abundant in 1861, and that in 1871 "there were quite a number on the rivers, more than usual; but not in great force."

HAMILTON. (1) In small numbers. (3) Were here seventeen years ago.

SOME DOUBTFUL REPORTS.

Mr. Meredith, a member of the Senior Class of the Agricultural College, and a resident of Taylor County, informs me that there were no Cicadas in that county this year, but that *they were there in* 1863. He says he "is certain as to the last date." Unless there is some mistake in this, we have here a small area of a third brood—Professor Riley's Brood No. XV. [See 1st Mo. Ent. Rep. p. 36.]

A Page County correspondent reports none this year, and says that the only one he has seen for many years was one he caught in 1864. Professor Todd, of Tabor College, Fremont Co. reports that he traveled extensively in Nebraska and southwestern Iowa in June of this year, and that he "neither heard nor saw one." He says further, "I find some old settlers who say they have never seen them. Two or three, however, have told me that some year between 1850 and 1860 they were abundant in some localities."

I incline to the belief that we must make here due allowance for the well known defective memory of the average man, and include Taylor and Fremont counties in the area of the brood of 1861. This would carry the western boundary line from Cass Co. to the northwest corner of the State, and would add six counties to the area as already made out. I have indicated the direction of this line on the map by a dotted red line. It will be seen to include Adams, Ringgold, Taylor, Page, and all or part of Fremont and Montgomery counties. This addition, if made, carries the whole number of counties in the area of this brood up to thirty-nine or forty.

As Professor Riley in the Report above referred to says that in 1861 the Cicadas [his Brood XIII] were at St. Joseph in northwestern Missouri, it is probable that this interpretation of the testimony from southwestern Iowa is the correct one.

It will be noticed that in many cases in the "Extracts" given above, the testimony is that there were fewer Cicadas in 1878 than when they were present last, *i. e.*, seventeen years ago. This fact, which is interesting in itself, *may possibly* afford an explanation of the fact that no Cicadas were seen this year in the southwestern counties. Possibly the decrease so generally noticed throughout the area of the brood, was simply *much greater* here than elsewhere.

Is this brood dying out? We can only begin to guess the answer after the next seventeen years shall have passed.

SOME NOTES ON THE BROOD OF 1871.

Incidentally I have obtained some valuable information regarding the area occupied by the Cicadas of the Brood of 1871,—Riley's Brood V,—the results of which I give below.

Twelve counties reported that in 1871 the Cicadas were more or less numerous. These are so distributed upon the map as to make it certain that at least four other counties must be added to the area; so that without doubt we may say that this brood occupied sixteen counties, or an area somewhat less than half as large as that of the brood of 1878.

The boundary line, as I have approximately drawn it [on Map I] runs from Louisa Co. to Tama Co. at a distance of some miles south of the north line of the brood of 1878; from Tama Co. it passes by an approximately straight line to near the northwestern corner of the State. I have definite information as to their occurrence in the following counties: viz. Louisa, Johnson, Iowa, Poweshick, Clinton, Cedar, Jones, Benton, Dubuque, Delaware, Buchanan and Clayton. Doubtless they also occurred in Muscatine, Scott, Jackson and Lima.

There is some uncertainty as to the western boundary of the area occupied by this

brood. It is probable that the line should be drawn from Tama Co. northward so as to include Mitchell Co. on the north line of the State.

Our informant reports that they were in Butler Co. "eight or nine years ago"—which may have been intended for the year 1871.

A correspondent in Mitchell Co. speaks of the year 1855 as "Locust Year",—and this may refer to 1854, which is the year of the brood of 1871.

On the other hand, a correspondent at Waterloo, in Black Hawk Co., says: "I would say from the most reliable information obtainable, they have not appeared here in twenty-five years, in numbers sufficient to attract attention." Another in Howard Co. says: "I have heard nothing of the Seventeen Year Locust since I came here in 1858." The testimony from Winneshick Co. is not clear; my correspondent knew of no "locust year" whatever.

A correspondent in Fayette Co. answers as follows: "(1) Now here. (3) Fourteen years ago. (4) The only locusts that have been here are those above mentioned." This would make the date 1864, which certainly is somewhat doubtful.

I am inclined to think that in the last cases, as in that of the brood of 1878, we may have to make corrections, and thus carry the western boundary line from Tama Co. through Bruner, Floyd and Mitchell, as I have indicated on Map I by a dotted blue line. That this area does not extend much if any west of this line is quite certain; the testimony upon this point is quite conclusive.

Cave Fauna in Jamaica.—During the spring of 1877, while in the island of Jamaica I examined many caverns, but found no blind, true cave animals. Insects were not however wanting, although they were all twilight-loving forms found in dark places above ground. In the Jamaican caves there occurred very abundantly a large cricket (?) with well developed eyes, but aborted wings and antennæ six inches long. Preying upon the cricket there was also found a Phrynus (*P. reniformis* Fab.?) with fore legs as long as the antennæ of its prey. Upon accumulations of bats' dung there lived multitudes of small flies, and upon the bats themselves besides large ticks, mallophagous parasites (*Trichodectes*), long-legged, active and wingless spider-flies (*Nycteribia*) and a winged parasitic fly (*Strebla vespertilionis?*). A Mycetophilid fly is found upon the stalactites, where its vermiform larva may also be seen suspended by ropes of slime. The outer portions of the caves are of course resorted to by many myriapods, cockroaches, etc. A curious Hymenopteron, *Evania lævigata* Oliv. was found parasitic on a large cockroach (*Beriplaneta*)—H. G. Hubbard.

ENTOMOLOGY IN AMERICA IN 1879.

Address of President J. A. Lintner, at the late meeting of the Entomological Club of the A. A. A. S.

[*Continued from p.* 19.]

To the study of the Tortricidæ—a family which has received scarcely any attention in this country since the death of Mr. C. T. Robinson, Prof. C. H. Fernald, of Orono, Me., has been devoting special and earnest attention. He has been able to examine nearly all the material contained in the principal collections in this country, and during the past winter has visited the larger collections in Europe for their study and a comparison with our forms. In England, the Tortricidæ in the following collections were critically examined by him: those of the British Museum, of H. T. Stainton, R. McLachlan, C. J. Barrett and Lord Walsingham; and on the continent, the collections in Brussells, Berlin, Munich, Naples, of Prof. Zeller in Stettin, Dr. O. Staudinger, MM. Deyrolle and Ragenot and the Jardin des Plants in Paris. The above amount of preliminary work should certainly enable Prof. Fernald, as is his hope, to present us with a re-arrangement of this extensive family quite in advance of any heretofore proposed. Prof. Fernald has prepared a synonymical list of our North American species, which is nearly ready for publication.

The work of Mr. V. T. Chambers on the Tineidæ of the United States, has been vigorously prosecuted, as may be seen in

his frequent publications in the *Canadian Entomologist.* His papers on *Tineina and their Food-Plants*, and *Index to the Described Tineina of the United States and Canada* (Bull. U. S. Geolog.-Geograph. Surv., vol. iv., pp. 107–167), have been appreciatively received as very convenient for reference.

The comparatively small but difficult group of the Pterophoridæ has engaged the attention of Mr. Charles Fish, of Oldtown, Me., and his studies have already made him our best authority in these forms.

From the above references to special studies in several of the families of the Lepidoptera, it will be seen that this attractive Order gives every promise of soon occupying high vantage ground.

In the other Orders—it is quite unnecessary that I should refer in the Coleoptera to the labors of Drs. LeConte and Horn. You all know of their untiring work, which has made the field which they are so thoroughly working almost exclusively their own.

In the Diptera, Mr. C. P. Whitney has published descriptions of a few species of Tabanidæ.

Mr. W. H. Patton has communicated some descriptive papers on Hymenoptera to the *Canadian Entomologist.*

Mr. E. T. Cresson has published a catalogue of North American Apidæ, with descriptions of new species, comprising 108 pages of vol. vii. of the Trans. Amer. Entomolog. Soc.

Some valuable lists of species, collected in particular regions have been given us, which are of service in extending our knowledge of Geographical Distribution. Among these, in the Coleoptera, may be mentioned, a list by E. A. Schwarz of 1,457 Florida species (Proc. Amer. Philosoph. Soc., v. 17, pp. 353–472); of 1,246 species from the Lake Superior region by H. G. Hubbard and E. A. Schwarz; by the same, of 1,787 species from the lower peninsular of Michigan (loc. cit., v. 17, pp. 593–666); by Dr. LeConte, of 220 species collected in the Rocky Mountains at an elevation of 6,000 feet and upwards (Bull. Geolog.-Geograph. Surv. Terr., v. 4, pp. 447–480); additions to Messrs. Austin and LeContes' Catalogue of the Coleoptera of Mt. Washington, of 89 species, extending the number to 319, by F. Gardiner, Jr. (Psyche, v. 2, p. 211); 316 species from Wallace Co., Kansas, by F. H. Snow (Trans. Kans. Acad. Sci., vol. vi., pp. 61–70); and additions of 435 species to the Catalogue of Kansas Coleoptera, by E. A. Popenoe (ut. cit., pp. 77–86), increasing the number to 1,711.

In the Lepidoptera, Mr. C. E. Worthington furnishes a list of 229 species of Noctuidæ from the vicinity of Chicago, Ill. (Canad. Entomol., v. xi., p. 68); Mr. W. L. Devereaux, a shorter list of species taken in Wayne Co., N. Y. (ut. cit. p. 105); Prof. F. H. Snow, a list of 104 species collected in Colorado, by the Kansas University Scientific Expedition in 1876.

The valuable biological studies of Mr. W. H. Edwards have been continued with their wonted earnestness. Through the success attained by him in carrying a large number of species of butterflies from the egg through their transformations, he has secured their entire life-histories, several of which have been published during the past year, and others illustrated in the volume of the *Butterflies of North America.* Of the Satyridæ, the larvæ of which are so rarely met with that I may venture to say many members of this Club have not seen a living example, he has reared all of our Eastern species with the two exceptions of *Satyrus Pegale* and *Chionobas semidea.* The interesting experiments in producing change in the imago by the application of cold to the chrysalis have been continued and been duly recorded.

A large number of biological papers have been contributed to our entomological journals. From those accessible to me at the time of writing I find contributions from the following: C. J. S. Bethune, J. Boll, Robert Bunker, V. T. Chambers, A. J. Cook, Charles Dury, H. Edwards, W. H. Edwards, J. H. Emerton, G. H. French, H. A. Hagen, E. C. Howe, D. S. Kellicott, J. L. LeConte, B. P. Mann, T. L. Mead, C. V. Riley, W. Saunders, C. G. Siewers, Emma A. Smith, F. H.

Snow, C. E. Webster, O. S. Westcott, C. E. Worthington, and G. D. Zimmerman—a quite incomplete list of the contributors to this department.

Results of anatomical studies of insects have been published by Messrs. C. F. Gissler, J. D. Hyatt, E. L. Mark, and C. V. Riley.

It would be inexcusable in a notice of biological work to omit reference to what is being done in this direction at the Museum of Comparative Zoology at Cambridge. Under the hand of the eminent Curator of the Entomological Department, Dr. H. A. Hagen, a biological collection of insects has been brought together that is far in advance of any similar collection in the world. It was my privilege recently to give it a partial examination, and when I say that I know not how to express my high estimation of it, I give it but imperfect praise. No one, whose studies have prepared him for the appreciation of such a collection, can examine it without wondering when, where and how the material was obtained. As an illustration of the natural history of species, in their several stages, architecture, depredations, food-plants, diseases, parasites, etc., it is difficult to see how its plan of arrangement can be improved. In consideration of its high value, it is very gratifying to see that such unusual means have been resorted to for its preservation, as, with a reasonable supervision and without the operation of other than the ordinary causes of destruction, will extend its benefits to our successors in coming centuries. In addition to the biological collection, two others have been arranged: the one comprising the insects of North America, and the other those of the world. Of the number of type specimens contained in these collections, there is not the time at present, nor is it the occasion, for more than simple mention. The student in American Entomology, who aims to be fully abreast of the most advanced progress in his line of study, cannot neglect the means of information which the Collections and Library of the Entomological Department at the Cambridge Museum offer him.

The published results of economic investigations during the year have been quite limited. In consideration of the exceeding importance of these studies, it is painful to have to record the fact of the issue of but one Annual Report of a State Entomologist—that of Cyrus Thomas. This second report of Dr. Thomas, forming the seventh in the series of the Illinois reports, is a volume of nearly 300 pages. In it Dr. Thomas discusses the depredations of some of the Orthoptera, Coleoptera, and Hemiptera. Prof. G. H. French, Assistant Entomologist, presents brief descriptions of a large number of diurnal and nocturnal Lepidoptera and their larvæ, with notices of their habits, accompanied by analytical tables for their identification. Miss Emma A. Smith, special Assistant Entomologist, offers the results of original investigations in some species of special economic importance. The publication of this and the preceding Report, without, as is evident, the opportunity of the revision and correction of proof by the authors, is much to be regretted, as serious errors in the nomenclature and elsewhere have thereby been given extensive circulation.

The Annual Report of the Entomological Society of Ontario, making the ninth in the series, contains its usual amount of matter of interest to the entomologist, and of value to the agriculturist and horticulturist.

Several articles treating of insect depredations have appeared in our scientific journals, which cannot now be referred to.

The United States Entomological Commission, continued by an appropriation by the last Congress of $10,000, is actively engaged in its second year's operations. In its investigations of the Rocky Mountain Locust, its labors have been almost entirely confined to that portion of country designated as the Permanent region, with a view of determining the limits of these permanent breeding grounds, and to obtain the requisite data for the preparation of a map, and a scheme to be recommended to the Government, by which the excessive multiplication of the species in that region, and the consequent migration therefrom,

may be prevented. It is understood that the recommendation to the Government will be, that in connection with the authorities in British America, efforts be made to restrain the extensive prairie fires in autumn which are common to that region, and subsequently to burn them in the spring after the hatching of the young locusts. This plan is believed to be feasible, as the breeding grounds are not co-extensive with the so-called Permanent region, but are limited to the richer valleys, plateaus and river borders within it.

The Commission will also, it is understood, in its forthcoming Report, recommend to the Government a scheme for a system of warning and prevention, through the aid of the mounted police patrol of the Dominion Government, and our Signal Bureau and military posts.

Having been favored with a transcript of the subjects to be treated of in the forthcoming 2nd Report of the Commission, and the assignment of subjects to the respective members of the Commission, I have no hesitancy in giving assurance of a volume of unusual interest and value. It is to be hoped that Congress will not repeat the inexcusable blunder of ordering of it an edition by far too small to supply the demand, or for the accomplishment of a main object in its laborious preparation—the diffusion of the needed information among those to whom it could not fail of proving beneficial.

The Commission is also occupied with investigation of the Hessian-fly and the Chinch-bug—each of which are chargeable with annual injuries to the amount of several millions of dollars.

The investigation of the natural history and habits of the Cotton-worm, commenced by the Department of Agriculture last year, has by direction of Congress, been transferred to the Entomological Commission. Prof. Riley has been pursuing its study in Southern Texas and in the Gulf States, aided by special assistants, and it is believed that discoveries have recently been made which will reduce the cost of destroying the larvæ to perhaps a fourth of what it has hitherto been.

Among the special subjects of study which have claimed attention lately, an interesting one has been the pupation of butterflies. Observations made during the past year on the pupation of some of our butterflies have shown us that we have been at fault in accepting the account given of it by Reaumur over a century ago, and received and quoted by subsequent authors. The most interesting operation in the pupation of the suspensi butterflies is the withdrawal of the chrysalis from the larval skin, the casting off of the skin with its attachment by the terminal legs to a button of silk spun for the purpose by the larva, and the attachment and suspension of the chrysalis by its anal spine to the silk button. Reaumur represented it as accomplished by the chrysalis in its extensions and contractions grasping the larval skin between the segments, and by this means raising itself until it regained the button. Recently Mr. Osborne, an English Entomologist, discovered a membrane serving as a suspensory agent in the change to the pupal state, and for the first, questioned the account given by Reaumur. His observations were confirmed by those of Mr. W. H. Edwards, and followed up by additional observations on large numbers of Nymphalidæ and Danaidæ, some of which have been presented in the *Canadian Entomologist.* There seems to be no question of the existence of such a membrane, and that it consists of the portion of the larval skin lining the region of the rectum, caught upon two knobs conveniently placed for the purpose. Prof. Riley, in a communication to *Psyche* (vol. ii, p. 249) finds other means of chrysalis suspension—the principal one being the shed intestinal canal, and accessory ones, the tracheal vessels of the last pair of spiracles; these Prof. Riley regards as the principal agents in suspension. In opposition to this Mr. Edwards considers these ligaments as of but little, if any service, and finds the membrane to furnish all the requisite support. Additional observations are required to reconcile these different views.

The beds of fossil insects recently dis-

covered in the Tertiaries of our western Territories are proving to be wonderfully rich in number of species and condition of preservation. From a single small basin exposed by a railway cut in the vicinity of Green River Station, Union Pacific Railroad, in Wyoming, Mr. S. H. Scudder in *Fossil Insects of the Green River Shales* (Bull. U. S. Geolog.-Geograph. Surv. Terr., iv, No. 4, pp. 747-776) enumerates eighty species, representing all the orders of the Insecta except Lepidoptera. An idea of the richness of these beds may be obtained from the statement, that a two hours' search was rewarded by the collection of fifty new species. We are glad to learn that Mr. Scudder is engaged upon a general work on our fossil insects, which will form one of the volumes of the quarto reports of the Hayden Survey—the beautiful typography and illustration of which causes us to regret the prospective speedy termination of the series. As the Tertiary Shales of the Rocky Mountain region give every promise of being richer in insect remains than any other country in the world, the material for this volume will be more ample than any other student in fossil entomology has been able to command.

For the evident omission of reference to much valuable work done during the period reviewed, I ask indulgence. The time that I had allotted to the preparation of my sketch was found, too late, to be quite insufficient for the extended biographical examinations required for even an approach to completeness. I offer it only as a partial sketch, and as such please accept it.

Statistics gathered for the forthcoming annual report of the New-Jersey Labor Bureau include reports from sixty-seven silk mills, mostly in Paterson. The Paterson mills alone employ 10,000 hands, besides from 2,000 to 3,000 employed in their own homes. The annual production of these mills reaches the total of $14,-000,000.—*Scientific American.*

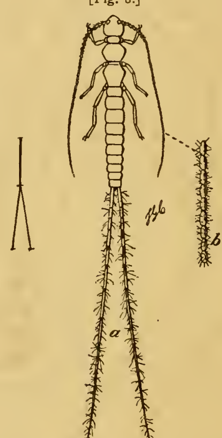
It is officially announced that the French vintage for 1879 is 30,000,000 hectolitres under the average of the last ten years.

TWO DAYS' COLLECTING IN THE MAMMOTH CAVE, WITH CONTRIBUTIONS TO A STUDY OF ITS FAUNA.

BY H. G. HUBBARD, DETROIT, MICH.

During the past summer, while acting as entomologist to the Kentucky State Geological Survey, I made, at Prof. Shaler's direction, repeated examinations of the limestone caves in the vicinity of Pennington's Gap in the Cumberland Mountains of Lee Co., Va., without however finding a single specimen of any true cave insect, except a cricket (*Raphidophora*). Being dissatisfied with this negative result, and anxious to test my powers in a locality known to be inhabited by blind insects, I

[Fig. 8.]



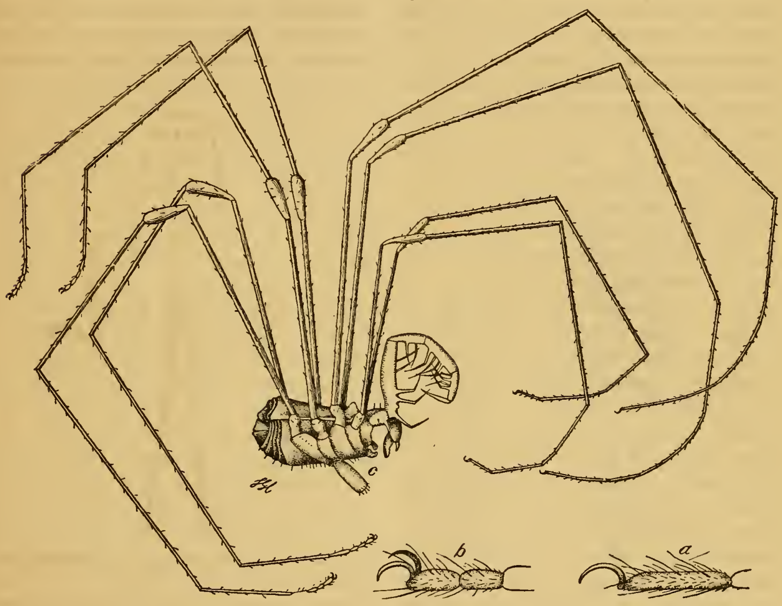
CAMPODEA sp.: *a*, dorsal view; hair line showing natural size; *b*, part of antenna, still more enlarged (after Hubbard).

determined on my return to make a short visit to the Mammoth Cave. Accordingly on the 19th of August, in company with one other member of the Survey party, I found myself in the stage coach, rapidly traversing the ten miles of hilly country that intervenes between the railroad at Cave City and this world-renowned cavern. We reached the hotel about six o'clock in the evening, and, after supper, joined a party which we found about to take "the short route," a tour in the cave of three and a half miles and the same distance back, making a walk of seven miles.

We entered the cave, the mouth of which is in a little hollow behind the hotel, and after proceeding about two hundred yards found ourselves in a very large chamber called the Rotunda. Here two avenues lead off, one to the right, the other to the left. The left-hand turn is taken by all parties making either the "long" or the "short" route, and to the Rotunda they must always return on the way out. The passage to the right is an immense gallery, like a great tunnel, eighty feet wide and forty feet high, and about three miles long. It is called Audubon Avenue, and has but few branch galleries, none of them very long. The first side passage that leaves Audubon Avenue is a mile long, and opens at its end into the top of Mammoth Dome. So one may follow this passage to eternity, by stepping from the top to the bottom of Mammoth Dome, a distance of two hundred and fifty feet.

As I was anxious to begin at once my acquaintance with subterranean life I decided to remain behind, leaving the guide and his party to continue their route, and arranging to meet them here in the Rotunda on their return at eleven o'clock. I watched their fading lights and listened to the rapidly diminishing sound of their footsteps as they receded down the long passage, then turned into Audubon Avenue, and following previous instructions, found and traversed to its end the side passage leading to the jump-off into the dome. The gallery was however very dry, and after careful search, finding no insects, I lost no time in returning to the Rotunda. This is also a dry chamber, but in a few places the walls are slightly moist, and there are ledges upon which the droppings of bats are collected. I found at last on one such moist shelf a little pile of fresh bats' dung, and on disturbing it, three or

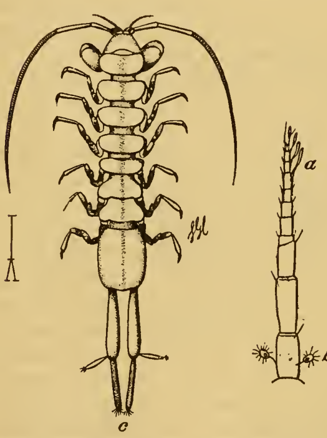
[Fig. 9.]



PHRIXIS LONGIPES: *a*, claw of anterior tarsus; *b*, claws of posterior tarsi; *c*, spider enlarged ten times (after Hubbard).

four specimens of *Adelops hirtus* ran swiftly away from it and hid in cracks, or in the shadows of small projections of the wall, as though they perceived and shunned the light of my lamp. Their manner was exactly that of a *Catops* when similarly disturbed. Before the return of the party I succeeded in finding one other moist crevice with bats' dung, about which I found and captured a few more specimens of Adelops. My friend N. who had gone with the guide, brought back a specimen of *Anophthalmus Tellkampfii* and two of Adelops, both found at Richardson's Spring. This is one of the places where parties stop to take lunch, and crumbs of food are left scattered about. The guide William, who assisted Dr. Packard in his

[Fig. 10.]



CÆCIDOTEA STYGIA: magnified six times, with inner short antenna of left side (after Hubbard).

explorations, thinks it the best locality in the cave for *Anophthalmi*, but I did not visit it.

The next morning N. and I returned to the Rotunda, and found a fresh supply of Adelops about the same bits of dung where I had taken them the night before. Other and better ledges also turned up, and we secured in all about thirty specimens of the beetle. While examining the side walls a small patch of clay adhering to the rock, attracted my attention from its lumpy appearance, and picking at it I opened a small oval cell in which was a pupa, evidently of Adelops. This was a grand discovery, and while N. made a search for other lumpy patches, I carefully uncovered four cells, all that were found together in this piece. Each cell contained a pupa, and I collected them with the skins of the larvæ. Near by I found another and then a third cluster, and N. found one or two more, all within a foot or two of the floor. The number of cells in each cluster varied from four to twelve. One cell enclosed a larva, and two or three others contained recently transformed imagos of *Adelops hirtus*. In the immediate vicinity we also found a few larvæ feeding upon bats' dung in company with imagos, some of the latter quite young and soft, evidently not long out of their pupa cells. I have since examined and verified Packard's figure of the larva (*Am. Naturalist*, Vol. x, pl. II) which proves to be correctly ascribed to this beetle, and very well represents its appearance when contracted by strong alcohol. The history of Adelops is therefore now complete. At the end of this paper will be found descriptions, with figures, of the larva and pupa.

Nearly every part of the Rotunda is very dry and devoid of life, the corner in which the cells of Adelops occured, had however a slight cave dampness, and so well repaid our search that we devoted the greater part of the morning to examining this recess alone.* The carcass of an ox lay here close to the wall and partly buried beneath a heap of stones and earth. Though long past the stage of putrefaction, if indeed the ordinary process of putrefaction ever takes place in the pure air of the cave, and entirely odorless, the flesh still

* The manufacture of saltpetre, abandoned in 1812, was formerly carried on very extensively in the Rotunda, where traces of the "works" may still be seen in the remains of huge wooden troughs and water pipes, and a general litter of boxes and barrels about the chamber. Oxen were at that time employed in the excavations, and lived and died here. In later times three log houses were erected in the Rotunda, which for a time were tenanted by a small colony of consumptives, who hoped to prolong their lives by living in a climate that does not vary the year round. Like the oxen these unfortunates quickly succumbed to the dampness and darkness, and left behind them, if not their bodies, many another rich feast for the mites and mould.

adhered to the bones, in a wet and mouldy condition, communicating its moisture to surrounding objects. Upon pieces of wood and boards that lay upon this heap, and were thus kept perpetually moist, we captured seven specimens of *Campodea*, (Fig. 8, described hereafter) and four of *Machilis*, both of which though blind had the habits of their relatives the Bristle-tails and Poduras, also five specimens of the blind Pseudo-scorpion, (*Chthonius Packardi* Hagen, described and figured in the second part) and two specimens of a transparent and delicate *Psocus* with small eyes and rudimentary or undeveloped wings. The last is perhaps a wanderer from without, but the three former are blind and colorless, true cave forms. The larger cave fly (*Anthomyia*) was common about the ledges, and a single specimen of *Anophthalmus Menetriesii*, which presents an extreme amount of variation, was discovered after much searching, deeply hidden in a crevice, four feet above the floor.

Some of the numerous fragments of wood that lay scattered about the chamber were covered with thick downy masses of brown or white mould, and no life could be found upon them. The greater part were however dry and but slightly mouldy, and upon such pieces we discovered four specimens of a Lathridiid beetle, (*Corticaria*) with well-developed eyes, and not differing remarkably from other cellar-inhabiting species of the same genus.*

At noon my friend left me and returned to the hotel. I was too much excited to interrupt this my first acquaintance with a true cave fauna, and momentarily expected to find a new beetle or to make some other grand discovery. I left the Rotunda and proceeded along Audubon Avenue perhaps a quarter of a mile, to the first sharp turn. Here I heard water dripping at the summit of a long hill of loose rock which rose before me to the roof of the dome. Up this I climbed until I reached the spot upon which the water fell. Most of it sank at once between the rocks and disappeared, but accumulations of sand here and there retained shallow pools, and formed tiny beaches among the fallen fragments. The wet sand was seen at the first glance to be covered with the tracks of insects, as if the hillside swarmed with life. And in fact crickets (*Raphidophora subterranea* Scud.) and their young were quite numerous upon the wet stones, although they were congregated in still greater numbers upon the side walls and roof. Almost the first stone I turned uncovered an *Anopthalmus*, but it fled like a shadow into a crevice and saved itself. Three or four others, however, shortly fell into my clutches, and then during an hour's hunt I could find no more. My movements had, I suppose, frightened the rest, and caused them to seek shelter in the cavities below. I took however two specimens of a minute blind spider (*Anthrobia*) which were running upon the sand. I next turned my attention to the pools of water, and though none of them were larger than an ordinary wash-bowl, I found them all veritable little aquaria, well stocked with the Crustacean described by Packard (*Cæcidotea stygia*, Fig. 10). Some of the pools contained twenty or thirty specimens in all stages of growth. In company with them occurred not rarely a leech, or possibly worm, of very slender form; not thicker than an insect pin, but capable of extending its delicate body to a length of two inches. Being almost transparent these creatures were rendered visible by their shadows only.

This ended the day's collecting. I returned to the hotel, and in the evening looked over my specimens, each lot of which were collected separately in small vials of alcohol. They were all transferred to fresh vials of alcohol, and carefully cleaned from sand and other impurities.

The following day we resolved to visit

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* Packard's list of wanderers into the cave does not include this beetle. He mentions (*Am. Nat.* v, p. 286) from neighboring caves, *Batrisus spretus*, *Quedius fulgidus*, and two other Staphylinid beetles, probably both common *Philonthi*, but his beautifully executed figures are rendered valueless for specific determination by the omission of the punctation and other details. Cope also names three species of beetles taken within the mouth of Wyandotte Cave in Indiana, *Catops* n. sp.? *Quedius spelæus* Horn, *Lesteva* n. sp. and an Aleocharid allied to *Tachyusa* (*Am. Nat.* vi, p. 413.).

the river Styx, which is at the lowest level of the cave and about three miles from the entrance by the route usually taken. There is however another route, called the Corkscrew, which cuts off two and a half miles of this distance, but is a very narrow and difficult passage. It begins in the upper level near the Rotunda, and sinks abruptly to the deepest gallery of the cave. The first part of the descent, through an almost vertical well, is made on ladders, and the remainder by a steep declivity over rough rocks. A large party of visitors was going by the long route to the end of the cave, and a guide was to be sent in advance with a basket of provisions. N. and I decided to take advantage of this arrangement, and following the guide "Pete" down the Corkscrew, after a short, but somewhat exciting descent, we found ourselves in the long avenue leading to the river, which we reached an hour in advance of the main party.

With this avenue the water system of the cave communicates at several points, forming pools known as Lake Lethe, the River Styx, and similar Plutonic appellations. The floor of the avenue is of fine sand, and at high tide the water rises from forty to fifty feet, filling it nearly to the roof. When the Green River rises above a certain height a submarine connection is established between its waters and those of the so-called river of the cave, which then rises and falls with the water outside. At the time of our visit the flood was at its usual summer ebb, and these stygian pools lay in motionless tranquility, their crystal depths undimmed, and their glassy surfaces unruffled by current or eddy.

Arrived at the point where the River Styx crosses the gallery, we found Charon's boat drawn up upon the sand, and depositing our burdens, we began a search along shore for blind fish and crawfish. The forms of several were soon seen floating like white phantoms in the almost invisible water, and we captured with an insect net several small specimens of both species of blind fish, *Amblyopsis* and *Typhlichthys*, which resemble each other closely, but want the ventral fin in the latter genus. We took also good specimens of the cave crawfish (*Cambarus pellucidus* Tellk.), and in addition a gigantic female of *Cambarus Bartonii*, the common crawfish of the Green River, but which has quite often been found in the cave waters. A very unexpected find however was a common frog. He was resting upon the sand, not far from the water, and was somewhat emaciated, and apparently much discouraged. A fish with large and perfect eyes, probably a darter, showed itself in one of the large pools. It remained for some time motionless at the surface of the water, within easy reach, but "Pete" missed it with the net, and it vanished in a twinkling, not to appear again. A single *Anophthalmus*, found running on the sand, was the only insect, except crickets, seen here. When therefore the party arrived we decided to accompany them farther. We embarked with them in one of the boats, and leaving the gallery on our left, pushed under a low, wide arch, and floated for half a mile in an aqueduct, like a mammoth sewer, over water thirty or forty feet deep. The guides, standing up in the bows, propelled the boats by pushing with their paddles against the low roof. At its end, the river sinks beneath the wall of rock, but another great gallery opens here at the side, and another system of halls and avenues begins, the farthest point of which, and the end of the "long route" is still a walk of six miles from the river. We landed and hurried on before, three miles farther to Washington's Hall, a chamber of the largest size, and for many years the lunching place of tourists. The floor of the hall is of white gypsum sand strewn with fragments of the same material. The larger masses of gypsum afford convenient seats and tables for picnickers, and are strewn about with chicken bones and bits of food. The accumulation of such rejectamenta is very great, to be reckoned perhaps by the cart-load, yet notwithstanding the presence of so much offal, kept perpetually moist by contact with the gypsum sand, not the slightest taint is perceptible in the air of the chamber, only

at close quarters the recently deposited morsels give off a peculiar rancid odor. As before in the Rotunda I was struck with the conviction that decay in the cave is an exceedingly slow process, accomplished mainly through the agency of a few fungi.* Prof. Tyndall has shown that in the pure atmosphere of the Alps, perishable infusions of meat and vegetables remain unchanged for an indefinite length of time.† May it not be that the equally pure and bracing air of these caverns is likewise comparatively free from the germs of Bacteria, Vibrios and other agents of putrefaction and fermentation? It has been asserted by the guides, that meat hung up "at the mouth of the cave" will keep fresh a long time.‡ But if Bacteria are absent, other scavengers in abundance attack this food material. I found it swarming with the larvæ of Adelops and the maggots of a small fly (*Phora*). The imagos of the beetle, and puparia of the fly were also present in countless numbers. The adult beetles were very agile, and on being disturbed when gathered in a cluster about a bit of meat, they scattered in every direction over the sand, so that it was difficult to pick them up rapidly. I found the best method to be to throw the lump with Adelops clinging to it on to a handkerchief. The beetles then hid in the folds of the cloth and could be picked up by a quill passed through the cork of the collecting bottle. In this way we secured several hundred specimens in a few minutes. To secure a good supply of larvæ it was sufficient to tie up in a cloth one or two small fragments of chicken bone crowded with insects. These unfortunately remained forgotten in my collecting sack, until after my return home a week later, when I found and examined them They were much crushed, and the larvæ all dead, but of twenty or more adult Adelops which adhered to the lumps, and had been imprisoned with them, two were still alive. Both however died after another week's confinement. Some of the puparia of the fly were also uninjured, and in a few days several perfect Phoras made their appearance from them. Three or four living mites (*Acarus*) and a very minute Psocid, (*Atropos divinatoria* Muell.) possessing eye-spots and undeveloped wings were also found upon the lumps.

Washington's Hall was said to be a good locality for Anophthalmus, but we found only a few specimens under flat pieces of gypsum. The party of sight-seers had in the meantime gone on to the end of the cave, and a few minutes before their return "Pete," who remained behind with us, proposed to take us to a place where plenty of Anophthalmi could be found. He then led us back a short distance to a passage called Martha's Vineyard. Here the rocks are damp, with some dripping springs and one quite large pool known as Hebe's Spring. This locality did not disappoint our expectations. It is one of the best in the cave, but as we had but a few minutes time, we were obliged to hurry over the ground and could delay but a few moments in one place. The guide constantly moving on, called back to us that it was dangerous to fall behind. At Hebe's Spring the repairing of a stairway left the timbers of the former structure scattered about, and under these, *Anophthalmus Tellkampfii* and *A. Menetriesii* were common, the former much more abundant than the latter however. I found here under a piece of wood lying on sand a specimen of a larva which agrees perfectly with Packard's figure of that of *A. Tellkampfii*.* We also secured two specimens of *Phrixis longipes*, (Fig. 9) the blind Phalangid spider or Harvestman described by Cope.† With a little more time at our disposal, I feel sure that the pupa of Anophthalmus would have been found at this spring, as many of the imagos

* The fungi of our caves have not as far as I know been studied. Two species have been identified by Dr. Farlow from the Mammoth Cave, *Ozonium auricomum* Link, the mycelium of an unknown fungus, and *Stemonitis ferruginea*, also immature. A list by Pokorny of fungi from the Adelsberg and Lueg caverns, (Germany) extracted from Dr. Ad. Schmidt's "Die Grotten und Hoehlen von Adelsberg," Wien, 1854, and kindly sent me by Dr. Hagen, enumerates nineteen species, all found above ground, and originating, as Pokorny thinks, from spores introduced from without on wood.

† For an account of these experiments see *Popular Science Monthly* for Feb., 1878.

‡ During the summer months, when the temperature outside is higher than that of the cave, (59° F.) a strong current of air flows out of its mouth. The in-coming supply is said to be by filtration through the rocks, in which case it would be very probably freed of floating germs.

* Am. Naturalist, Vol. x, pl. II. † Ibid. vi, p. 421.

taken here were quite fresh. The pupa has however already been figured by Packard in his paper on the beetles of the cave. While I devoted myself to hunting under stones and boards for other insects, taking only an occasional specimen of Anophthalmus, "Pete" and N. were capturing numbers of the latter, all of them resting in exposed places upon the side walls, where it was quite damp, and usually several feet from the floor. They were not at all difficult to find or to capture, and we took about thirty specimens while rapidly passing over the first half mile of our route back to the river.

The party overtook us soon after we reached the boats, and without making any further stops we hurried back, reaching the mouth of the cave at 8 o'clock P.M.

I intended to return to Hebe's Spring on the following day, as our examination of this locality was entirely insufficient, half of the day being consumed on the journey there and back. This however proved my last collecting in the cave, for on reaching the hotel I found a message summoning me home.

In examining the results of my two days' collecting I find in forty specimens of *Anophthalmus Tellkampfii* but little variation. Of twelve *A. Menetriesii*, three show considerable variation in size and form, and one is plainly pubescent. An undoubtedly new species of this genus has been detected among specimens of the latter species, which I have named *A. interstitialis*.* A small mite (*Acarus?*) infests the bodies of the Anophthalmi. While studying the larva of *Adelops*, and observing the action of the muscular lobes that close the rectum at the end of the anal tube, by pressure I succeeded in expelling the fœces in ovoidal masses, and along with them several thread-like bodies, curved in the shape of a fish-hook and pointed at the ends. Under a magnifying power of 250 diameters they appear to be filled with granules, and are thicker and shorter than *Trichina spiralis*. I suspect that they are intestinal worms.

[*To be continued.*]

* A description of it will be found in the Descriptive columns of this number.—ED.

SOME REMARKS ON FUNGI CONSIDERED AS INSECTICIDES.

BY PROF. W. H. SEAMAN, WASHINGTON, D. C.

An article has recently appeared in the *Canadian Entomologist* for June last from the pen of Dr. H. A. Hagen, in which it is proposed to propagate certain parasitic and other fungi to destroy insects injurious to Agriculturists. The success of this novel remedy depends on the genetic connection alleged to exist between the fly fungus, "common mould," the yeast fungus, and a small water plant known only to professional botanists. What this latter may be is altogether left to conjecture. The connection is vouched for by Dr. Bail of Prussia, whose experiments cover more than a dozen years, but whose views are "not accepted by prominent botanists."

It is unfortunate for students of fungi that the names of the above plants are not given with more precision, "common mould" and "a small water plant known only to professional botanists" are not sufficiently definite terms to inspire confidence in the investigations on which the new remedy is founded.

The word mould in popular language is applied to many species of cryptogamous plants that differ widely in character, and have no genetic connection with each other. The mould on paper on damp walls, is usually a Chætomium, that on pea leaves is an Erysiphe, both of which bear their spores in little capsules, or asci. The mould on fermenting liquors is at first some Torula, which Pasteur has shown is intimately connected with the process of fermentation. It consists of single cells that propagate by budding, and it is not yet demonstrated that they increase in any other manner. It is to this plant the names of "yeast fungus," "vinegar plant," etc. are given. When the Torulas have exhausted the sugar, other species of moulds, as Aspergillus and Penicillium appear to complete the decomposition of the fluid. Again, the moulds composed of masses of white threads that appear in cellars on damp wood, etc. are not perfect fungi at all, but

are the first stages in the growth of toadstools, that is, Agarici and Polypori.

Which of the above Dr. Hagen would have us believe grows from the fly fungus it is difficult to say. The fly fungus is a species of the genus Saprolegnia, formerly called Sporondonema, Empusa, or Achlya. It consists of short jointed threads, two to five millimeters long, growing from the body of flies, usually in Autumn. These threads enlarge in the outer end or last joint, which becomes filled with swarm spores that as soon as mature burst their envelope, move about for a few hours, then come to rest, generally near the parent filament and immediately begin to grow. It has been asserted hy some authors that this plant is identical with the fish fungus, which destroys eggs and young fish in fish-breeding establishments. Other writers make several species in this class of fungi, dependent on variations in the form of the filaments and peculiarities of the sexual organs. The sexual characteristics of the Saprolegnieæ connect them more closely with Peronospora or the rusts, such as cause the potato disease, than with any other class of fungi, but no one but Dr. Bail has yet suggested a specific relation between them.

We fear the observations of Dr. Bail have not been made with such care as to compel full credence. Dollinger and Drysdale have shown that the microscopic monad has a cycle of growth as definite and unvarying as any quadruped, and fungi, in all their wonderful varieties of fructification, do not pass certain well marked limits of modification. The spores of Saprolegnieæ and of numerous moulds are continually floating in the air in larger or smaller numbers according to the season, and their development depends upon nice conditions of temperature and moisture that man cannot control. Supposing it were possible to find a parasitic fungus to attack the grasshopper, the conditions of its growth must be provided, and we apprehend this would be impossible.

The rarity of epidemics of fungi shows how seldom all circumstances combine with sufficient nicety to allow an injurious development. The "pébrine" of the silkworm must be regarded as the result of enfeeblement of the constitution of the worms caused by an artificial life. But Dr. Bail is not alone in his views with regard to the polymorphic development of microscopic spores. Metcalfe Johnson in the Monthly Microscopical Journal of 1871, vol. 6, p. 217, describes with what appears to be irrefragible precision and fullness of detail, the development of moss (a mnium) from monads. This is only one of several statements affirming polymorphic development, which do not yet receive much attention, because of a conviction in the minds of accurate students, that many of them assert positively, what is yet doubtful, as regards the extent of variation. It often happens that one species of fungus grows on another without any but an accidental local relation between the two, and it is in this way so easy to be mistaken, that nothing but the most careful and repeated observation will establish a genetic connection between forms so remote from each other in character, as saprolegnia and yeast, and it is certain that these observations are yet to be made.

TWO VALUABLE INSECTICIDES.

London Purple.*

This powder is obtained in the following manner in the manufacture of aniline dyes. Crude coal-oil is distilled to produce benzole. This is mixed with nitric acid and forms nitro-benzole. Iron filings are then used to produce nascent hydrogen with the excess of nitric acid in the benzole. When distilled, aniline results: to this arsenic acid, to give an atom of oxygen which produces rose aniline, and quicklime are added to absorb the arsenic. The residuum which is obtained by filtration or settling is what has been denominated "London Purple," the sediment being dried, powdered, and finely bolted. The powder is, therefore, composed of lime and arsenious acid, with about 25 per cent. of carbonaceous matter which surrounds

* From advance sheets of Bulletin No. 3 of the U. S. Entomological Commission, by C. V. Riley.

every atom. Experiments which I made with it in 1878 impressed me favorably with this powder as an insecticide, and its use on the Colorado potato-beetle by Professors Budd and Bessey, of the Iowa Agricultural College, proved highly satisfactory. I was, therefore, quite anxious to test its effect on the Cotton-Worm in the field on a large scale, and in the winter of 1878–79 induced the manufacturers to send a large quantity for this purpose to the Department of Agriculture. The analysis* made of it by Professor Collier, the chemist of the Department, showed it to contain:

	Per cent.
Rose aniline	12.46
Arsenic acid	43.65
Lime	21.82
Insoluble residue	14.57
Iron oxide	1.16
Water	2.27
Loss	4.07
	100.00

Through the liberality of the manufacturers, Messrs. Hemingway & Co., a number of barrels of this powder were placed at my disposal the past season and distributed to various observers and agents in Georgia, Alabama, and Texas. Early in the spring Mr. A. R. Whitney, of Franklin Grove, Illinois, found it to be a perfect antidote to the canker-worms which had not been prevented from ascending his apple-trees, and the experiments of those whom I had intrusted to make them on the Cotton-Worm, as well as those made under my own supervision, all showed that its effects are fully equal to those of Paris green. Like the latter it kills the worms quickly and does not injure the plants, if not applied in too great a quantity. Farther, it also colors the ingredients so as to prevent their being mistaken for harmless material. Finally, its cheap price removes the temptation to adulterate the poison, as every adulteration would prove more expensive than the genuine article. It is even superior to Paris green, as, owing to its more finely-powdered condition, it can be more thoroughly mixed with other ingredients and used in smaller proportion. Experiments on a large scale have been made with the dry application at the rate of 2 lbs. to 18 lbs. of diluents, also at the rates of 1, ½, ¼, and ⅛ lb. to 18 of the diluents. The last proved only partially effectual, and in no case were the plants injured or the leaves even burned. In all but the last case the worms were effectually killed, but as the mixture, at the rate of ¼ lb. was applied with greater care and regularity than is generally had on a large scale, and also in very dry weather, the proportion of ½ lb. to 18 of the diluents is most to be recommended. All higher proportions are simply waste of the material.

Like Paris green, it is not soluble,* but is much easier kept suspended in water than the former. If applied in this way some care has to be taken in stirring it in the water, as it has a tendency to form lumps, owing to its finely-powdered condition. Experiments on a large scale with this material diluted in water gave the following results: When used in the same proportion as Paris green, namely, 1 lb. of the poison to about 40 gallons of water, one experimenter reports that the leaves were slightly crisped, while four others report a perfect success, and no injury whatever to the plant. Experiments by myself and Mr. Schwarz showed that when applied in the proportion mentioned and thoroughly stirred up in the water the leaves were partly crisped, though by no means so much as by arsenic, even when applied in weaker solution. When used in smaller proportion, or at the rate of ¾ or ½ lb. to 40 gallons of water, it did not burn the leaves and still proved effectual in destroying the worms. Repeated experiments on a smaller scale confirmed these results obtained on large fields, and also showed that the proportion may be still farther reduced, and when applied with great care and in very dry weather ¼ lb. to 40 gallons will kill. Still farther reduction in the proportion of the powder used gave negative results. I would, therefore, recommend the use of ½ lb. of this powder to from 50 to 55 gallons of water as the pro-

* Ordinarily the Rose aniline has mixed with it a little ulmic acid, and an increase of 2 per cent. of arsenic acid.

* The manufacturers can render about 13 per cent. of it soluble if desired.

portion most likely to give general satisfaction by effectually destroying the worms without injuring the plants.

All that has been said under the head of Paris green as to the desirability of adding a small quantity of flour or other substance to give adhesiveness to the liquid will hold equally true of London purple, but the latter has in many respects a great advantage over the former, especially in its greater cheapness, being a mere refuse which, from its poisonous nature, was a drug to the manufacturers and had to be gotten rid of by being dumped long distances out at sea. This substance can be put upon the market at the bare cost of transportation. It can be sold in New York at the low rate of 6 cents per lb., and there is no reason why it should not be obtained at any of the large shipping points in the South at figures ranging between 7 and 10 cents a pound. This means virtually that the cost of destroying the worms by this powder is reduced to such a minimum as to depend mainly on the labor and the other ingredients or diluents employed; in other words, that, while the planters, as heretofore, were obliged to pay as much as $1 for the first cost of the active poison needed for one acre, and never less than 15 cents, he may now obtain it for from 3 to 5 cents.

London purple has this farther advantage over other arsenical compounds hitherto employed: Its finely-pulverized condition seems to give it such penetrating power that, when used in liquid, it tints the leaves so that cotton treated with it is readily distinguished at a distance, the general effect being quite marked as compared with any of the other poisons similarly applied. It seems also to be more effectually absorbed into the substance of the leaf, and is therefore more persistent. At the same time experience shows that it does not injure the squares any more than Paris green.

Pyrethrum Powder.

The insecticide and insectifuge qualities of the dried and finely-powdered flower-heads of different species of *Pyrethrum*, and the harmlessness of the powder to man, to other animals, and to plants, have long since been known. Used against various household pests under the names "Persian Insect Powder" or "Dalmatian Insect Powder," it has hitherto been put up in small bottles or packages and sold at such high prices as to preclude the idea of using it on a large scale in the field. The so-called Persian Powder is made from the flowers of *Pyrethrum carneum* and *P. roseum*, while that from *P. cinerariæfolium*, a native of Dalmatia, Herzegovina, and Montenegro, is more generally known as Dalmatian Powder. Some interesting experiments made during the past year on different insects by Mr. William Saunders, of London, Ontario, show that the use of this powder may be satisfactorily extended beyond the household, while a series which I made in the summer of 1878 with the same powder on the Cotton-Worm showed it to have striking destructive powers, the slightest puff of the powder causing certain death and the almost instant dropping of the worm from the plant. Repeated on a still more extensive scale the present year at Columbus, Tex., the powder proved equally satisfactory in the field.

Here, then, we have a remedy far exceeding any other so far known in efficacy and harmlessness to man and plant, and the only question in my mind has been to reduce its cost. There was some hope of doing this by ascertaining the destructive principle, and it is to Prof. E. W. Hilgard, of the University of California, that we owe the first accurate determination of the same. The following extract from a letter received from Professor Hilgard last September indicates the results of some of his experiments:

DEAR SIR: Yours of 22d is to hand. I have had Milco's product in hand for some time, and have tried it on various bugs both in powder and infusion. To understand the best manner of using it in each case, it must be kept in mind:

1. That the active substance is a volatile oil.
2. That said oil, under the influence of air, not only volatilizes, but is also oxidized, and thereby converted into an inert resin.

It follows from 1, that the pyrethrum is at a disadvantage when used in the shape of powder in the open air, especially when the wind blows; from 2, that it is of the greatest importance that

the substance should be fresh, or should have been kept tightly packed, for the same reason that hops must be similarly treated.

Hence I find that Milco's fresh powder is of greater efficacy than the best imported, although some of the latter contains twice as much matter soluble in ether; but the extract from the "buhach" is a clear greenish oil, while that from imported powder, and especially that from "Lyon's magnetic"—ground-up refuse, stems, etc., as I take it—is dark and thickish, or almost dry and crumbly.

Like all volatile oils, the essence of pyrethrum is soluble in water to some extent, and the tea from the flowers, and to a less extent that from the flower-stems and leaves, is a valuable and convenient insecticide for use in the open air, provided that it is used at times when it will not evaporate too rapidly, and that it is applied in the shape of spray, whose globules will reach the insect despite of its water-shedding surfaces, hairs, etc. Thus applied, I find that it will even penetrate the armor of the red scale bug—or rather, perhaps, get under it—so that the bug falls off dead, in a day or two. The hairy aphides are the most troublesome, and require a strong tea of the flowers, atomized. The diluted alcoholic solution can, of course, be made as strong as you please, and will kill anything entomological.

Some persons have tried the decoction, and have of course failed, as the oil is dissipated by boiling.

My own experiments and those of Professor Hilgard were made with the powder from plants grown in California by Mr. G. N. Milco, of Stockton, and this powder, when used fresh, I have found to be more powerful than the imported kinds. Mr. Milco, a native of Dalmatia, has been cultivating the *P. cinerariæfolium* in California in constantly increasing area for the past three years, and deserves great credit for his efforts in introducing it. The California product is put upon the market in neat bottles and packages under the name of "Buhach," and I am under obligations to Mr. Milco for the liberal supply which he has placed at my disposal free of cost, wherewith to carry on my experiments. Before considering the cost of using this insecticide in the cotton-field it will be well to summarize the results of these experiments.

Pure Pyrethrum powder, mixed with a small quantity of finely-powdered rosin, was applied to the under-side of the leaves by means of a small pair of bellows. Taking advantage of the direction of the wind, and using the bellows freely, all the upper leaves of the plants were found to be well powdered, and consequently almost all the worms upon these leaves received at least some particles. The smaller worms died in convulsions in from 10 to 20 minutes, according to their size, and to the quantity of powder they had received. Larger worms soon became uneasy, and finally fell to the ground, where they invariably died in from 5 to 24 hours.

Every attempt to restock with worms a freshly-powdered plant failed. They evidently do not like the smell of the powder, and throw themselves from the leaves until they either fall to the ground or reach a leaf which has not been powdered.

Diluted with flour in varying proportions from one part of each up to one part of Pyrethrum and ten of flour, it produced equally good results as when pure. Mixed with 16 parts of flour, it proved at first insufficient, but upon being kept in a tight glass jar for two weeks, it evidently gained in power, for it then proved almost as effectual as the stronger mixtures. The powder can be successfully sifted on the plants during cloudy days or during the evening when the worms are on the upper side of the leaves. On sunny days, or when the worms are just hatched, it is more necessary to apply it to the under side of the leaves, as it acts only when coming in actual contact with the worms.

A strong decoction of the powder applied to the leaves produced no effect; nor did the worms appear to suffer from eating leaves thoroughly soaked with this decoction.

An alcoholic extract of the powder, diluted with water at the rate of one part of the extract to 15 of water, and sprayed on the leaves, kills the worms that have come in contact with the solution in a few minutes. The mixture in the proportion of one part of the extract to 20 parts of water was equally efficacious, and even at the rate of 1 to 40 it killed two-thirds of the worms upon which it was sprayed in 15 or 20 minutes, and the remainder were subsequently disabled. In still weaker solution or at the rate of 1 to 50 it loses in efficacy, but still kills some of the worms and disables others. I confidently recom-

mend, therefore, the alcoholic extract of Pyrethrum, diluted at the rate of 1 part of the extract to 40 parts of water, and sprayed upon the plants, as an effectual remedy against the worm.

The extract is easily obtained by taking a flask fitted with a cork and a long and vertical glass tube. Into this flask the alcohol and Pyrethrum is introduced and heated over a steam tank or other moderate heat. The distillate, condensing in the vertical tube, runs back, and, at the end of an hour or two the alcohol may be drained off and the extract is ready for use.

Let us now briefly consider the approximate cost of using this material at present figures. The powder is now selling in California at wholesale, in 8-lb. packages, at $1.25 per lb.; but from facts kindly communicated by Mr. Milco, it appears that he has raised as much as 647 lbs. to the acre, and that the cost of production, milling, etc., on a large scale, need not exceed 6 to 7 cents per lb., because in the experiments attending the introduction of the plant many obstacles and expenses incident to new enterprises have had to be met. The plant is wonderfully free from insect enemies and blooms all through the summer, and there seems no good reason why it should not grow in most of the Southern States.

Carefully estimating from the results of experiments made, it will require about one and three-quarter pounds of the Pyrethrum powder to go over an acre of cotton at medium height; in other words, that quantity of Pyrethrum to 20 lbs. of flour or other diluents will answer the purpose. Such being the case, the question as to whether the Pyrethrum can be used as a substitute for Paris green, London purple, and other arsenical powders resolves itself in one of relative market price, and if Mr. Milco's estimates are warranted—and no one in the country is better able to state the facts or give the figures on the subject—the Pyrethrum may be produced as cheaply as even London purple. It is a question which future experience alone can determine, but that the prospects are encouraging there can be no question, and it is highly probable that the planter in the future will make it a rule to grow a patch or a few rows of this most useful plant as a ready means wherewith to protect his crop from the worm whenever the occasion for so doing presents itself.

So far as experiments have been made there would seem to be a decided advantage in point of economy in the use of the crude powder, since, in the ordinary methods of spraying, 40 gallons of liquid are required for an acre, and to produce this amount of diluted extract of Pyrethrum at the above figures would require about six pounds of powder. This diluted extract has the advantage, however, over every other liquid so far used that it contains no solid and obstructing particles. It may, therefore, doubtless be used in a much finer spray than any of the other poisons.

INTELLIGENCE IN ANTS.—Whilst weeding in the garden last August, I broke open the upper galleries of a nest of small black ants, and in so doing scattered a number of eggs, which had been carried up from below, that they might be warmed by the sun, which at the time was shining brightly. As I watched the ants gathering them into the nest, I noticed a little fellow dragging one, two or three times larger than himself, up what must have seemed to him a very steep hill; at last he stuck fast, and, after a few plucky efforts, he left the egg, made a few casts round the ground to see how the "land lay," and then returned to the egg, which he pulled up an easy ascent, of which he had been in search, and which was in quite another direction to the one in which he was going when he stuck fast.—Thomas Winder, Sheffield, in *Science Gossip*.

THE BEHEADING OF FLIES BY A WESTERN PLANT.—Professor Gray requests those who have an opportunity of obtaining the plants *Mentzelia ornata* and *M. nuda*, both of which occur in our western plains and prairies, to investigate whether this cruel behavior to flies is well founded. It is declared by a French naturalist, who has studied it in Paris, that the stiff

bristles or barbs of each whorl of the plant are interspersed with softer ones, which secrete a viscid matter attractive to insects. Flies thrust the proboscis into the harpoon-like bristles, and when withdrawn the head is held fast. The harder the backward pull, the more extensive is the attachment to the sharp barbs, and the head becoming congested, the insect is seldom able to disengage it, and it is twisted off by the gyrations made.—*Gardener's Monthly.*

THE CHINCH-BUG.*

AMOUNT OF INJURY IT CAUSES.

The Chinch-bug (*Blissus leucopterus* Say) is unquestionably one of the most formidable insect pests with which the farmers within the wheat producing area of the United States have to contend. Although not exceeding a grain of wheat in size, rather slow-motioned and possessing no other weapon of destruction than its tiny slender beak, yet the species is enabled to make up by number for the lack of individual capacity for destruction.

The locusts of the West are the only creatures of this class "which exist within the bounds of our national domain whose multiplication causes more sweeping destruction than does that of this diminutive and seemingly insignificant insect." In the territory east of the Mississippi it is without a rival.

Mr. Walsh estimated the loss from the ravages of this insect in Illinois alone in 1850 at 4,000,000 dollars, an average of $4.70 to every man, woman and child then living in the State.

Dr. Shimer says that it "attained the maximum of its development in the summer of 1864, in the extensive wheat and corn fields of the valley of the Mississippi, and in that single year three-fourths of the wheat and one-half of the corn crop were destroyed throughout many extensive districts, comprising almost the entire Northwest, with an estimated loss of more than 100,000,000 dollars in the currency that then prevailed."

* From advance sheets of Bulletin No. 5, of the U. S. Entomological Commission, by Cyrus Thomas.

Mr. Thomas, in his second report, as State Entomologist of Illinois, remarks as follows in reference to the loss occasioned by them in 1871:

"I find no complaints of damage recorded in 1870, but as the summer was dry over a large area, and they appeared in immense numbers in 1871, it is more than probable that they began to increase in the latter part of the season."

As Dr. LeBaron has noticed somewhat fully in his second report their operations in 1871, it would be unnecessary for me to do more than advert to it were it not for the fact that this second report does not appear to have been generally distributed and is rarely seen. The following quotation will suffice to show the extent and severity of this visitation:

"Some idea of the loss caused by the depredations of this insect, in this and neighboring States, may be realized when we learn that over a belt of territory one hundred miles wide, commencing in the western part of Indiana, and extending more than four hundred miles west, embracing an area of more than forty thousand square miles, the great staple of spring wheat was reduced to not more than a quarter of an average crop, and in many places wholly destroyed; and that over the same territory barley was less than half a crop, and oats not more than three-quarters of their usual amount.

"The center of this belt appears to have been a little north of the center of the State, being about on a line with the junction of Iowa and Missouri, and taking in a corresponding part of southern Iowa and Nebraska, and of northern Missouri and Kansas. South of this belt winter wheat takes the place of spring wheat and barley, and the Chinch-bugs, though present in considerable numbers, ceased to commit any very serious damage. North of this belt, also, notwithstanding that spring wheat constitutes a leading crop, the bugs became gradually less numerous, and a tolerable crop of this grain was harvested. And yet all through northern Illinois and the southern part of Wisconsin, these insects were numerous enough to damage the crop to some extent, and to excite the most serious apprehensions for the succeeding year.

"In order to obtain as correct an idea as possible of the amount of loss sustained by the agriculturist from the depredations

of this insect the past year (1871), both in this and the northwestern States, I have made the following calculations based upon the statistics of the Department of Agriculture, with a reasonable estimate of the proportional damage caused by this insect to those crops upon which they depredate. All such calculations must necessarily be only approximately correct, and very loose and extravagant conjectures have sometimes been indulged in upon the loss caused by Chinch-bugs in former seasons of their prevalence. It has been my intention to keep within reasonable bounds and by giving the figures in the case, I give others the opportunity to review my estimates.

"Taking the returns of the Department of Agriculture, for the years 1869 and 1870, for our guide, we may assume the present annual yield of wheat in the State of Illinois to be 30,000,000 of bushels, of oats 40,000,000, and of barley 3,000,000.

"The area seriously ravaged by these insects, comprised, as we have above stated, about the middle third of the State. This section would bear its full proportional third of the wheat and oats, and at least one-half of the barley raised in the whole State. This would give as the product of that part of the State ravaged by Chinch-bugs 10,000,000 bushels of wheat, upwards of 3,300,000 bushels of oats, and 1,000,000 bushels of barley. The proportion of these crops destroyed by Chinch-bugs we have put at three-quarters of the wheat, one-half of the barley, and one-quarter of the oats. This will give as the amounts actually destroyed by these insects, 7,500,000 bushels of wheat, 500,000 bushels of barley, and in round numbers, 3,300,000 bushels of oats.

"If we make a cash estimate of this loss, by putting the price of wheat at one dollar a bushel, barley at fifty cents, and oats at twenty-five cents, we shall have an aggregate loss of upwards of eight and a half millions of dollars in the central third of the State of Illinois.

"In this estimate we have made no account of the injury done to corn throughout the State, nor of the damage to small grains north of the central belt. Here the calculation becomes more indefinite, but I believe it will be generally admitted to be a low estimate if we add, for this purpose, one-quarter part to the above aggregate of loss. This will make the total loss caused by Chinch-bugs, in the State of Illinois, in the year 1871, upwards of ten and a half millions of dollars. If we assume an equal amount of loss for the two States of Iowa and Missouri combined, and another equal amount for the four States of Indiana, Kansas, Nebraska, and Wisconsin, we shall have a total loss in one year, in the northwestern States, of upwards of 30,000,000 of dollars, from this one species of insect."

The loss in 1874 was probably equal to that in 1864.

Prof. Riley made a careful estimate by counties of the loss in Missouri which he found to aggregate the large sum of 19,000,000. I made careful estimates of the loss on corn alone in Illinois by this insect in 1874. These estimates were based on different data so as to form checks the one upon the other, and the loss by drouth was eliminated. The result showed a loss of about 20,000,000 of dollars on this single cereal. The entire loss to the State that year by the operations of this pernicious insect were not less than 30,000,000 dollars, $11.50 to each inhabitant.

If the loss in the two States, Missouri and Illinois, amounted to nearly 50,000,000, it is not probable that the entire loss to the nation by this diminutive insect in 1874 fell any short of 100,000,000 dollars.

As the species appears to have a maximum of development about every five years, the foregoing estimates render it probable that the annual loss to the nation by its operations averages $20,000,000.

The phylloxera has, up to the close of last year, extended over more than 1,600,000 acres in France, and utterly ruined the vines in 700,000 of them. The appearance of the insect is even reported in the Medoc, the most famous vine-growing section of France, and Chateau Lafitte for which Baron Charles Rothschild paid $830,000 two years ago, is nearly ruined. At this rate, it is expected that the whole district will be infected before the end of next year. Sulphuret of carbon is the most favored remedy, though deep trenching and manuring, with an application of turpentine and powdered rosin to the roots, is said to be a cheaper and equally effective remedy. Some vine-growers are planting American stocks, thinking them less liable to attack. —*Land and Home.*

A VALUABLE PRESERVING FLUID.

The *Zoologischer Anzeiger*, edited by Prof. J. V. Carus of Leipzig, Germany (No. 45, December 29, p. 669–70), publishes the Letters Patent of the Wickersheim Preserving Fluid. The inventor claims that animal or vegetal bodies impregnated with this fluid or kept in the same will retain their form, color and flexibility in the most perfect manner. The objects to be preserved are put in the fluid for from six to twelve days, according to their size, then taken out and dried in the air. The ligaments remain always soft and movable, and the preserved animals or plants are for many years fit for anatomical dissection. In order to perfectly preserve the color it is necessary to leave the objects in the fluid, or, if taken out and dried, to keep them in air-tight vessels.

This preserving fluid is made in the following way: Dissolve 100 g. alum, 25 g. common salt, 12 g. salpetre, 60 g. potash and 10 g. arsenious acid in 3,000 g. boiling water. Filter the solution and when cooled add to 10 litres of the fluid 4 litres glycerine and one litre methyl-alcohol.

We understand that the German government, after thoroughly testing the value of the mixture as a preservative fluid, paid a handsome sum for the patent, and now publishes the recipe *pro bono publico*.

USE OF BUCKWHEAT TO DESTROY INSECTS.

Here is something new to us in the way of an insecticide. It comes to us from the other side of the Atlantic. Perhaps it works on the principle of the "hair of the same dog curing his bite," for it has long been claimed that a too free use of buckwheat cakes caused cutaneous eruptions in man, and that the raw grain had a similar effect upon birds. It is a fact, also, well known to entomologists, that the plant is wonderfully free from insect attacks. The Tartarian buckwheat referred to in the following extract from *The Farmer* (Lond.), has a rough kind of grain different from the ordinary varieties, and it is sometimes cultivated in the New England States under the name of Merino Buckwheat:

Many years' practical experience has convinced M. Lagarde that sowing buckwheat in soils infested by white worms, grubs, ants, etc., etc., allowing it to grow till it flowers, and then plowing or digging it in as green manure, effectually frees them from all their subterranean parasites. The proportion of buckwheat to be sown is about a hectolitre per hectare. The crop, especially the variety known as Tartary buckwheat, springs up rapidly, chokes all the weeds, and abstracts but little nitrogen from the soil as it draws its principal nutriment from the atmosphere. It further possesses the property of decomposing very quickly in a good soil, doubtless owing to the spongy nature of its leaves. This decomposition is immediate, and it is at this moment that larvæ, etc., underground are asphyxiated by the large quantities of gas disengaged. M. Lagarde further suggests that good results might be obtained in combating the phylloxera by sowing buckwheat among the vines in close rows, and digging the young crop in with the fork as near to their roots as possible.

Early Stages of Ephemeridæ.—The Rev. A. E. Eaton would like to communicate with anybody who would supply him with examples in fluid of nymphs of some of the American genera of Ephemeridæ. He would readily offer to pay a fair price for them and would defray their carriage to England. All that would be required would be 5 or 6 nearly full grown examples of one species per genus, put up in narrow tubes or narrow cylindrical bottles (one tube for each set) containing a solution of two parts of water to three of spirits about 60 over proof, well corked, and with the cork tied down. Some tissue paper should be put into each tube with the specimens, to prevent the solid contents moving about within the tube when its position is shifted, care being taken not to compress the insects; and the tube should be filled up as nearly as possible with the fluid to the exclusion of air-bubbles. The tubes should be packed up with cotton wool or tow in a box, so that they shall be kept upright during the voyage; and this box should be packed into a stronger case with tow or hay or straw, and forwarded to Mr. Eaton by express, or through the agency of some bookseller, *not through the Post Office*. Address Rev. A. E. Eaton, 51 Park Road, Bromley, Kent, England. We bespeak consideration of Mr. Eaton's request by those of our subscribers interested in the *Ephemeridæ*.

The metric system is now coming into such general use that measurements in fractions of an inch are preferably based on that system. We shall, therefore, adopt it in the ENTOMOLOGIST. Our readers will bear in mind that one millimeter equals about one twenty-fifth of an inch (more accurately 0.3937).

We are pleased at the manner in which our first number has been received. In addition to the list of promised writers given last month, we have assurances of support and occasional contributions from Mr. S. H. Scudder, Mr. Hermann Strecker, Mr. Chas. R. Dodge, Mr. E. A. Popenoe, Prof. Chas. Fish, Prof. C. E. Bessey and Mr. J. Monell.

SCIENTIFIC SYMBOLS.—The sign ♂ is used in natural history as an abbreviation for the word male, the sign ♀ for female, and the sign ⚲ for neuter. Since in insects the sexes of the same species are often quite dissimilar, we shall frequently use these signs with our illustrations, as an index to the sex of the insect figured. In astromony the first sign denotes the planet Mars, and the second the planet Venus. The sign ♀ has been known for centuries by the name of "crux ansata," or the cross with the handle to it, and occurs profusely on old Egyptian monuments.

INCREASE OF DESTRUCTIVE INSECTS IN CALIFORNIA.—In a recent letter Mr. C. H. Dwinelle, Lecturer on Practical Agriculture, at the University of California, writes as follows:

"I can assure you that we have no occasion to complain of a scarcity of insects here now. Our enterprising fruit growers and nurserymen have imported numberless species from all quarters of the globe, to add to our natural resources in this line."

☞ We have received so many encouraging letters and also numerous notices printed in newspapers throughout the country, that we must express our thanks through these columns instead of letters.

It will be our constant endeavor to seek to instruct the many who know little or nothing of entomology. To do so successfully we shall depend a great deal on good illustrations, and in proportion as our efforts meet with substantial support, we shall liberally illustrate the magazine.

DISINTEGRATION OF THE GENUS ACRONYCTA.—Mr. Butler communicated a paper (illustrated by an exhibition of preserved larvæ from Lord Walsingham) "On the affinities of the British moths usually placed in the genus *Acronycta*." He referred these to various old (mostly) Hübnerian genera, and the result of his analysis was as follows: *A rumicis* and *auricoma* should be transferred to the *Arctiidæ*, *leporina* and *aceris* to the *Liparidæ*; *megacephala*, *psi*, *tridens strigosa*, etc., to the *Notodontidæ*, whereas only *alni* and *ligustri* remained in the *Noctuidæ*.—Proc. London (Eng.) Ent. Soc. Nov. 5th, 1879.

Errata.—Page 3, for "*xanthomelina*" read "*xanthomelæna*." Page 3, 2nd col., line 24, transpose "Sonoma" and "Napa." Page 20, 2nd col., line 7, for "*Libellutæ*," read "*Libellulidæ*."

ON OUR TABLE.

On Litophane and New Noctuidæ. By A. R. Grote. 8vo. pp. 8. (Ext. from Bull. U. S. Geol. and Geog. Surv. Vol. V, No. 2.) Washington, Sept. 6, 1879. From the Author.

Eighth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Third Annual Report by Cyrus Thomas, Ph. D. 8vo. pp. 212. From the Author.

The Gardener's Monthly and Horticulturist, Vol. XII. No. 253. Jan. 1880. Philadelphia. From the Publishers.

Butterflies and Moths in their connection with Agriculture and Horticulture. A paper prepared for the Pennsylvania Fruit Growers' Society, Jan. 1879. By Herman Strecker. 8vo. pp. 22. From the Author.

The Butterflies of North America. By W. H. Edwards. Second series. Part VIII. 4to. 3 plates. Hurd & Houghton, Boston.

The Kansas City Review of Science and Industry. Vol. III, No. 9. Jan. 1880. From the Publishers.

Eighth Annual Report of the Curators of the Museum of Wesleyan University. Middletown, Conn. 8vo. pp. 15.

Annual Address of V. T. Chambers, Esq., President Cincinnati Soc. Nat. Hist. (Ext. from Journ. Cincinnati Soc. Nat. Hist. Vol. II, No. 2. July 1879.) 8vo. pp. 22. From the Author.

Description of the Storm of Easter Sunday, April 21, 1878, in Iowa. By Dr. Gustavus Hinrichs, Director of the Iowa Weather Service. 8vo. pp. 80. 6 plates.

The Maryland Farmer. Vol. XVII, No. 1. Jan. 1880. From the Publisher.

List of a Collection of Aculeate Hymenoptera made by Mr. S. W. Williston in Northwestern Kansas. By W. H. Patton. 8vo. pp. 22. (Ext. from Bull. U. S. Geol. and Geogr. Surv. Vol. V, No. 3.) Washington, Nov. 30, 1879. From the Author.

On Sex in Castanea Americana. Verb. Comm. By Thomas Meehan. 8vo. pp. 22. (Ext. from Proc. Acad. Nat. Sci. Phila., July 8, 1879.) From the Author.

Proceedings of the New-Jersey State Horticultural Society. 1876-77-78. From the Secretary.

EXTRACTS FROM CORRESPONDENCE.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

Wandering Habit of Larvæ belonging to the Genus Bucculatrix.—The first number of the ENTOMOLOGIST is at hand. I hope it may prove as useful and interesting as its predecessor of the same name.

I am afraid you will find that the "habit (of *Bucculatrix pomifoliella*) of forming its little ribbed cocoon in company on the bark" of apple trees, will not "give us the mastery over it." Like some of its European congeners the larva of this species has a habit of crawling away to considerable distances from its food-plant to spin its cocoon. I have sometimes found as many as twenty cocoons in a cluster on stalks of Elder (*Sambucus*) as much as fifty yards from the nearest apple tree; and have bred the moth from these same cocoons. But I have never found any indication that the larva (or any Tineid larva) feeds on leaves of *Sambucus*. This habit is not uncommon in larvæ of *Bucculatrix:* and this fact together with the singularity of a larva of this genus feeding on a coniferous tree, lead me to suspect that possibly *B. thuiella* Packard does not feed on *Thuja*. If I remember Dr. Packard's account he does not state that he saw the larva feeding, but only that he found it and the pupa on that tree; just as I found the pupæ of *B. pomifoliella* on *Sambucus*, which however does not feed thereon. Just so I bred *B. ambrosiæella* Cham. from *Ambrosia trifida* but did not see it feeding on it, and it may result that both *B. ambrosiæella* and *B. thuiella* are unfortunately named.—V. T. C., Covington, Ky.

Russian Remedy for Hydrophobia.—A correspondent of *Land and Water* (London), describes the following Russian treatment of Hydrophobia: In Saraton the inhabitants collect the larva of the rose beetle (*Cetonia aurata*), which are chiefly found in the wood-ants' nest. The grubs are gathered in the spring, placed in earth, and their change of metamorphosis watched for. When this takes place they kill the beetles and dry them. The powdered insect must be kept in hermetically sealed bottles, or the dried beetles may be kept in sealed pots and reduced to powder when wanted. Three beetles powdered are considered a dose for an adult, given immediately after the bite. One for a child and five for an adult in which the disease has declared itself. The effect is to produce a long sleep, which must not be interrupted. The bite is also treated surgically. The beetles caught on flowers are not so beneficial; they must be secured in the larva stage, and killed directly after they attain the imago. Some of the Russians give their dogs occasionally half a beetle as a preventative.

We give the above for what it is worth. As we have several species of *Cetonia* in the United States, perhaps some one may desire to go into the business of making Hydrophobia powder from them. These beetles may possess some curative properties not as yet discovered, but we leave the finding of it out to the medical faculty.

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Tipula Eggs in Stomach of Cat-bird.—If you will again look at the vial I sent, you will find a number of oblong black eggs, convex on all sides, in the same bottle with the ovipositors. The latter I put in as an illustration of the Tipulids found with the eggs. In fact, there is no evidence apparent that the cat-birds picked up the eggs separately. The occurrence of Tipulid fragments in every case where the eggs were found, would indicate that all the latter came from the abdomens of the females. S. A. F., Normal, Ills.

We failed to find any other than the Tipula eggs described, and were misled by our correspondent's language, as given on page 24 of our last issue. We entirely agree with him that the birds do not pick up the eggs separately, and shall be glad to receive specimens of the eggs he now describes for examination.

Beetles supposed to be feeding on Wheat.—A few months since our Professor of Agriculture received a small quantity of wheat from the Department at Washington. He planted the wheat, and upon examining the grains obtained from the crop, he found a large number of small insects that were rapidly destroying the wheat. I send one of these insects by this mail with the request that you will examine it for me and inform me what it is. By doing this you will greatly oblige

Yours very truly, P. H. M.
Agr. and Mec. Col. Auburn, Ala.

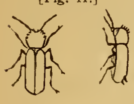
The insect you send, supposed to be destroying wheat received from the Department of Agriculture, is in reality the larva of some species of *Cryptorhopalum*, belonging to the family *Dermestidæ*. This family of beetles preys in the larval state upon a great many dead animal substances but is not known to feed on any vegetation. The probability is that the wheat in question was injured by some one of the numerous enemies to that grain, *e. g.* the common Grain-weevil, (*Calandra remotipunctata*) and that the larva you sent was preying upon its remains. If you will send a larger quantity of the injured grain I may be able to solve the question for you more satisfactorily.

The Apple-twig Borer.—Enclosed (in short quill) find beetle just taken from grape-vine in vineyard of Concords which was so severely trimmed last winter by an unskillful operator that scarcely an inch of the previous season's growth was left. Much of the old wood died down to the stocks and that dead wood has been

riddled by borers eating out the pith. Last summer the vines were not cared for but made immense growth of new canes. The management of this vineyard (2,200 vines) has just come into my hands, and in trimming I often find in the axils where buds start out, a perforation which leads to a hollowed channel extending a short distance both above and below the bud—the pith of the vine being eaten out.

In one of these chambers I found this beetle, alive but dormant. The same axillary perforations are abundant in young orchard trees set out last spring.

[Fig. 11.]



AMPHICERUS BICAUDATUS: *a*, female; *b*, male.

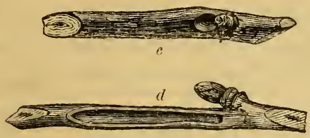
Please give me the name of the specimen sent and information whether the perforations are the work of this beetle in some of its forms, or of some other insect. Also best approved remedies or preventatives.

H. G. WOLCOTT.

Fremont, Neb.

The beetle sent by our correspondent is the common Apple-twig Borer (*Amphicerus bicaudatus* Say). It is extremely common throughout the Western States, and is more often received for identification during the winter and spring months

[Fig. 12.]



Apple twigs bored by *Amphicerus bicaudatus*; *c*, entrance; *d*, burrow cut open.

than any other beetle. Its habits being well described by our correspondent it suffices to say that it works not only in grape canes but in the more tender twigs of apple, pear, and peach trees. Both sexes of the beetle bore these holes and may then be found in them head downward at any time during the winter and spring months, the holes being made both for protection and for food and not for breeding purposes. Indeed the breeding habits of the insect are not yet known with certainty; for while Dr. Henry Shimer found certain larvæ in grape canes which he conjectured to be of this species (see Trans. Am. Ent. Soc. 1868, vol. II, p 9), yet they were doubtless those of an allied beetle (*Sinoxylon basilare* Say) which I subsequently reared from larvæ thus inhabiting grape canes—(4th Missouri Ent. Report, p. 53). Both sexes of the Apple-twig Borer have been found in the sap wood of forest trees, and species of the allied genus *Bostrychus* to which the insect under consideration used to be referred are ordinarily found with their larvæ in dry oak logs that are rotting. As I have already stated elsewhere: "the probabilities are that our Twig-borer breeds under the bark of oak trees and that it is in such situations that we must search for its larva. That it so breeds in the forest and not in the orchard, is rendered still more probable when we consider that its larval habits have so long evaded detection. We may furthermore infer that it comes to maturity late in the summer, and flying into our orchards and vineyards, the beetles bore into twigs during the Fall. Here winter overtakes them, and they hibernate in the holes, some of them dying; but most of them surviving until spring, when they continue feeding for awhile, and afterward repair to the forest again to propogate their kind. I have caught both sexes flying as early as the middle of March, during genial, sunny weather.

"The bored twigs most always break off by the wind, or else the hole catches the water in spring and causes an unsound place in the tree. If the twig does not break off, it withers and the leaves turn brown. The only way to counteract the injuries committed by this beetle is to prune the infested twigs, whenever found, and take great care to burn them with their contents. It is in the nursery that most injury is done, as the insect is seldom numerous enough in an orchard of large trees to more than cause what the philosophic orchardist has been wont to term 'a good summer pruning.'"—C. V. R. in New-York *Tribune*.

Stinging Caterpillar—You will probably remember that some time last summer I took the liberty of making some inquiries of you concerning insects, and particularly one by which I had been stung. You gave the supposed name and class, but said I had best send you a specimen to examine, which I do now, having obtained it from the limb of a pear tree. I have found it most frequently on this tree. In the summer it is found (as a hairy caterpillar about half-inch long, and quite thick, covered with a short, velvet-like down, rather coarse) on the leaves of corn, and the negroes call it "Corn-nettle." Harris describes an insect belonging to the *Lepidoptera*, named *Pithecieum*, which resembles the Corn-nettle, but does not answer the description fully. By giving me the name of this insect, you will much oblige. TH. POLLARD, Richmond, Va.

The cocoon enclosed by Mr. Pollard, though somewhat badly smashed, was recognizable as that of *Lagoa opercularis*, the larva being covered with soft hairs, but having urticating spines beneath them. This species feeds upon a number of different trees, and produces a moth remarkable for the woolliness of its body and wings. The color is cream-yellow, with some of the denser tufts of the front wings brownish, inclined to black. The antennæ of the male are very broadly pectinate, while those of the female are simple. The species is subject to the attacks of a particular Tachina-fly.

G. W. S., *New Smyrna, Fla.*—The tough cocoon with a hump on the back and which you find on orange trees, the larva doing considerable damage and stinging so severly that it is dreaded by the fruit pickers, is the same species.

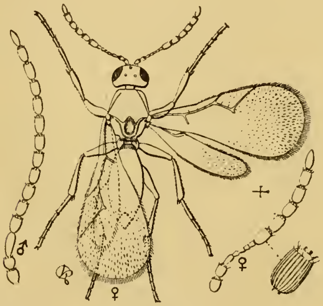
Descriptive Department.

A NEW GENUS OF PROCTROTRUPIDÆ.

BY C. V. RILEY.

Didictyum* Nov. Gen.—*Head* transverse; three ocelli, approximate and triangularly arranged; labial palpi 3-jointed; antennæ inserted in front and close together; in the ♀ hardly reaching to the abdomen, 13-jointed, the two basal joints stout; joints 3–7 suddenly narrowed and together not much longer than 1 and 2; 3 being twice as long as the others; 8–13 twice as stout, peduncled, subequal in length, very slightly narrowing toward tip: in the ♂ as long as body, 15-jointed, joint 3 twice as long as any of the others, 4–15 subequal in length. *Thorax* as long as abdomen, slightly wider in the middle than the head, scutellum prominently raised, subovate and marginally ridged; legs with the tarsi uniformly 5-jointed; front wings without stigma but with the veins forming with the costa two closed cells; hind wings with a stout costal vein, reaching and broadening to basal third of wing where it is suddenly bent upward. *Abdomen* narrower than thorax, with a short peduncle.

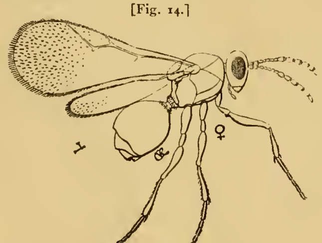
[Fig. 13.]



DIDICTYUM ZIGZAG: showing female from above, and male and female antennæ (after Riley).

D. zigzag, n. sp.—Average length 1.6^{mm}. Body uniformly polished black. Legs, palpi, and antennæ reddish in female; coxæ, femora, and antennæ toward tip infuscate in the male. Peduncled joints of antennæ with a few minute spines around the crown and longitudinally striate.

[Fig. 14.]



DIDICTYUM ZIGZAG: female from side (after Riley).

Base of thorax and of abdomen with pale pubescent hairs. Wings hyaline, sparsely beset with minute spines which increase radially and form a fringe around the posterior half; the veins of front wings forming a sprawling W with partial cross veins proceeding from the lower angles, the basal cross vein longest; the longitudinal veins with a few prominent spines. Abdomen, ♀, showing but 4 joints, the terminal three short and hardly distinguishable ventrally; abdomen, ♂, with the terminal joints more telescoped so as not to be seen from above.

12 ♀s, 5 ♂s reared by Prof. J. H. Comstock, from the chrysalis of *Aletia argillacea*,* in Alabama.

The genus is readily distinguished, by the character of the venation and the structure of the antennæ, from *Basalys* Westwood with which it has some affinity.

* Δίς double; δκίτυον, net.

DESCRIPTION OF A NEW ANOPHTHALMUS FROM MAMMOTH CAVE.

BY H. G. HUBBARD OF DETROIT, MICH.

Anophthalmus interstitialis, n. sp.—Pale rufo-testaceus, shining. Head elongate-oval, deeply arcuately bi-impressed, nearly as wide as prothorax. Antennæ slender. Thorax longer than broad, narrowed behind, sides moderately rounded, sinuate posteriorly, hind angles rectangular, base truncate, median line impressed throughout its entire length, basal impressions deep. Elytra elongate-oval, feebly convex, moderately deeply striate, the striæ obsoletely punctate and scarcely fainter at the sides, sides sinuate immediately behind the humeri, which are obliquely rounded, base prolonged at middle, elytral interspaces distinctly but sparsely punctured, more distinctly outwardly from the fourth, the punctures on alternate interspaces almost uniseriate, and each bearing a short erect hair. Length, 5.4.^{mm}; .21 inch.

A single ♀ from "Washington's Hall" in the Mammoth Cave.

The species is at once distinguished from all others in our fauna by the punctured outer interspaces of the elytra. Though plainly pubescent (the lines of hairs on the elytra are easily seen with a lens of moderate power) it differs from all other pubescent species by the thorax being longer than wide and the base of the elytra obliquely prolonged. The elytra moreover can not be called sub-opaque, and are hardly less shining than in *A. Menetriesi*. It is most closely allied to *A. tenuis*, which it resembles especially in its very elongate form, but differs by the very distinctly striate elytra. The elytra are less truncate at base than in *A. Menetriesi* and the punctures of the striæ are much finer and less distinct. The antennæ are long and slender as in *A. Tellkampfii* and the form of the body is even more slender. The penultimate joint of maxillary palpi is shorter than the last joint.

A specimen of *A. Menetriesi* from Mammoth Cave, in my possession, is plainly but very sparsely pubescent, there being a single row of fine hairs on each elytral interspace. Twelve other specimens of the same species all show traces of pubesence. The smallest individual among these measures but 4.8^{mm}; .19 inch in length, is somewhat lighter in color, more elongate in form, and with the hind angles of prothorax less acute.

* This description, without figures, appears simultaneously on p. 44, Bulletin 3 U. S. E. C.

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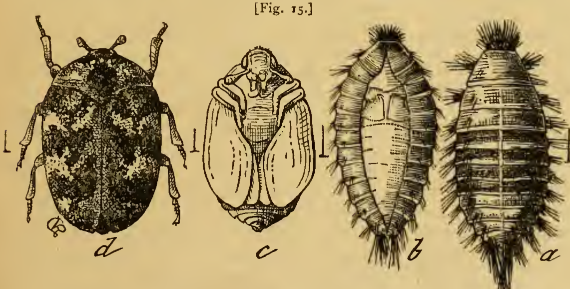
TRAPPING THE CARPET BEETLE.

The recently introduced Carpet-beetle (*Anthrenus scrophulariæ*), the larva of which is known under the rather misleading name of "Buffalo moth," bids fair to be even more injurious to carpets and woolen goods generally, than the old and familiar clothes moths belonging to various species of the genus *Tinea*. It has certainly become widely disseminated in this country, for many of our correspondents who employ a sweep-net in collecting, whether in Oregon, California, or any intermediate locality, obtain specimens every season.

[Fig. 15.]



IMPORTED CARPET-BEETLE:—*a*, larva; *b*, pupa, dorsal view, with split larva skin surrounding; *c*, do. ventral view removed from skin; *d*, beetle—hair lines showing natural size (after Riley).

For several seasons we were at a loss to know upon what kind of plant or plants the perfect insect fed, as it was quite evident that the persons who sent them had made their collections in the field and not in the house where the larva pursued its mischievous work. Last summer, however, in collecting pollen-loving beetles belonging to the genus *Mordella* upon the flowers of Spiræas, which they frequent, Mr. Fuller was somewhat surprised, as well as pleased, to find this very carpet pest at work among them, likewise feeding upon the pollen of the flowers. Every day for several weeks he caught some of these beetles on the same plants, but on no others in his garden.

It is quite probable that they do feed upon the pollen of other plants, but they appear to prefer the Spiræas. As these plants are indigenous to all parts of the country from the Atlantic to the Pacific ocean, the beetles can always find enough of them, if preferred to other kinds. It is very easy to capture the beetles while feeding, and it might be well to use the Spiræas as a bait, planting them about and near the house, not only to insure a visit from the beetles, but also to make it convenient for the members of the family to examine the plants frequently, and capture the little pests. The beetles after casting their pupa skin, pass out of the house into the open air to obtain food and meet their mates,

the females returning to deposit their eggs around the edges of carpets, or in almost any woolen stuffs, that are most convenient, though they seem to prefer carpets. The beetles (Fig. 15, *d*,) are so small (being scarcely more than one twelfth of an inch in length and somewhat less in breadth) that they can readily crawl in and out of any ordinary room without being observed, and if they were seen there are few persons who would take them to be anything more than some kind of seed, or lump of dirt, unless caught crawling or flying. But the larvæ (Fig. 15, *a*,) are larger, being nearly a quarter of an inch long, and covered with erect bristling hairs of a dark brownish color—their appearance probably suggesting the name of "Buffalo moth," in connection with the fact that the insect was first noticed as injuring carpets at Buffalo, N. Y. The word "moth" is very inappropriate, entomologically, as it refers to insects of another order, and the name we use is also preferable to "carpet-bug," "new carpet pest" and others by which it has been called. But no matter by what common name this species goes, it is doing a great amount of damage and in some parts of the country has become so abundant that housekeepers have had to dispense with all kinds of floor coverings made in part or wholly of wool, and use various kinds of matting instead.

We would advise trying the Spiræas as traps for this pest, planting the small flowering species, as these seem to be preferred by the beetles. The Goats-beard (*Spiræa aruncus*), Sorb-leaved, (*S. sorbifolia*) and the Meadow spiræa, (*S. ulmaria*). These plants are worthy of a place in every garden even if not utilized as beetle traps. There is, therefore, nothing lost if they do not prove useful for the purpose named.

Dr. H. A. Hagen in an interesting article read about a year ago before the Boston Society of Natural History, makes the following remarks on the European habits of this beetle and its workings in America :

The interest of the fact, beyond the sad consequences with which I have a sincere sympathy, is the sudden appearance and spreading of an insect over a large part of the United States, which seems doubtlessly imported from Europe. I had first some doubt about the *new* apparition, but the most reliable American authorities for Coleoptera affirm never to have met with this species before, except that a variety, also to be found in Europe, was found twenty years ago by Dr. J. L. Le Conte on flowers in California. Collections of North American beetles, sixty to eighty years old, as those of Melsheimer, Ziegler, and Harris, were consulted by me, but none of them contained the beetle, which is, by the way, of such variegated and striking colors that it would hardly be overlooked. In Europe the species is very common everywhere, living on flowers, but its destructive propensities were well known and described more than a century ago. There it likes to enter through the attic windows, and prefers to live on dead flies common in such places. But where it spreads from there through other rooms, it is just as obnoxious as it is here. Every woolen thing, collections of objects of natural history, plants, insects, birds, rawhides, hair, furs and similar things are quickly destroyed. As carpets are not in use in Europe except in winter time, and then mostly not fastened down near the walls, and as all carpets are carefully stored away during the summer, it has not the chance to be as destructive as here, as just the spring and summer are its most favorite seasons. Nevertheless it is rather difficult to understand that this insect was not introduced earlier, and I think the most plausible opinion is that a large lot of infested carpets bought in Europe and imported here has been the first cause of its alarming appearance.

In a communication to the *Farmer's Review* (Chicago), last spring, we remarked:

Most persons who have used tobacco, pepper, camphor, carbolic acid, and turpentine have found them of no avail ; on the contrary, the hairy creatures seem to thrive amid these substances ; but benzine or kerosene both effectually destroy it. Cotton, saturated with either of these substances, stuffed into the joinings of floors and crevices beneath the base-boards, during the winter months, will effectually destroy the pest. Benzine is certainly the least objectionable of the two substances, as it more rapidly evaporates and does not materially soil. Boiling hot water, which I first recommended, is much less objectionable than either, and will certainly prove as effectual. There is every reason to believe also that the pure Persian insect powder, when freshly ground, will prove a successful prophylactic. All methods of destruction must, however, from the tenacity of life possessed by the insect, prove annoying and troublesome. Hence the importance of prevention. Its distribution has been largely traced from a certain Boston carpet house, and all housekeepers, when purchasing carpets, should carefully scrutinize them before laying them down. Wherever they can be steamed, this proceeding will effectually disinfect them. Another effectual way of preventing injury is to use druggets. These, not being tacked down, are less subject to attack, and far more easily watched.

Dr. Hagen suggests the use of common tallow along the cracks and joints of flooring and of tallowed paper underneath the borders of carpets. The figure which we

give will introduce this unwelcome emigrant to those who have not seen it, and it is hardly necessary to add that it is the hairy larva (*a*) which does the mischief. The beetle is black, rather prettily varied with white and bright brick-red.

THE BEE NUISANCE.

To even refer to the Honey-bee as a nuisance under any circumstance will no doubt be resented by the professional apiarian. But there are neighborhoods where bees are kept in such large numbers that they do, in many instances, become an intolerable nuisance. Under exceptional circumstances bees actually puncture and work through the skin of tender fruit, but as the fact is strongly denied by those who have not witnessed it, we will pass over this mooted point for the present. All agree that they are ready to avail themselves of the depredations of other insects in this direction, as well as any accidental wound or crack of a delicious peach or other fruit, and it is not always pleasant to be compelled to be on one's guard in seeking a specimen, else gather a handful of bee-stings as a penalty for carelessness.

Last summer our neighbor's bees visited our peach trees at the time the fruit was ripening and in such numbers that it was positively dangerous to undertake to gather the peaches as they reached maturity from day to day. The bees also bored into the raspberries and blackberries and swarmed in the flower garden, and to cut a spike of scarlet sage, mignonette, or heliotrope without first brushing off the bees, was pretty certain to be followed with a thrust of a poisonous lance. But even these annoyances could be submitted to with a better grace than the visits of the little honey-gatherers to our greenhouses during the warm days of winter and early spring, before the flowers appear in the garden. There have been days during the past mild winter when so many bees visited the greenhouses that few persons would care to mix in their company, or endeavor to pick a flower. We once kept a few stands of bees, but had to dispose of them on account of their persistent visits to the greenhouse in the spring, at the time we were most busy working among the plants; but disposing of our own stock has not been much of a relief, on account of the nearness of neighbors who are engaged in bee-keeping.

We have no inclination to speak ill of the Honey-bee, but there is such a thing as having too many in a neighborhood, and when this occurs it becomes a serious question whether they should be treated as noxious or beneficial. We fail to see why a bee-keeper should have the right to pasture his bees on another man's land any more than his sheep or cattle, especially if they are a nuisance and do harm to his neighbor's property. In some parts of the country, men owning or renting a few acres of land keep bees enough to gather all the honey from the flowers growing in a circuit of several miles, and this they claim as a right, but upon what grounds we fail to discover. To keep bees in moderation is certainly not objectionable in the country, but there should be some limit even to the Honey-bee.—A. S. F.

POULTRY *vs.* IMPORTED CABBAGE WORM.—A correspondent of the *Prairie Farmer*, writing from Desmoines, Ia., states that allowing poultry to run among the cabbage plants has proved of no avail against *Pieris rapæ*, and cites a case in which hens with young chickens were tied among the plants, and the plants covered with corn meal. "The chickens," he writes, "apparently never touched a worm, even when covered with meal; nor did the hens drive off or capture the butterflies that hovered about in such numbers."

SILKWORM EGGS: SILK CULTURE.—We are continually receiving requests for Silkworm eggs; also for information on the rearing and culture of Silkworms. We have no eggs to dispose of and would refer correspondents to the Department of Agriculture which doubtless has, or to Mr. L. S. Crozier of Bayou Sara, La. We would also refer for general information on the subject to our "Manual of Instructions on the Production of Silk," being special report No. 11 of the Department of Agriculture, which can be obtained upon application to the Commissioner.

THE AILANTHUS SILK-WORM.

(Attacus [Samia] cynthia.)

[In the last number of *Science News*, a worthy monthly, the discontinuance of which we regret, we gave some account of the Ailanthus Silk-worm, and herewith reproduce portions of the article.—Ed.]

The serious failure of the French silk crop the present year has caused renewed attention to be paid to other silk producing worms. A recent article in the London *Times* draws attention to the fact that one of the principal difficulties in the way of utilizing the silk of the *Ailanthus* silk-worm has been removed by a device invented by M. Le Doux, that facilitates the unwinding of the cocoon and permits the twisting of several of the simple threads together. The difficulty in thus twisting or combining several threads of this silk has in the past proved the greatest hindrance to successful ailanti-culture. In view of the renewed interest manifested in the subject, an account of the insect will prove timely, and interesting.

[Fig. 16.]

Attacus cynthia:—*a*, eggs; *b*, larva; *c*, cocoon; *d*, chrysalis; *e*, female moth (after Riley).

The Ailanthus silk-worm is the only species of the different worms which have been introduced from Asia, either into Europe or America, which has proved of a hardy nature; or which has become fully acclimated. The vigor of its constitution may be likened to the characteristics of

the tree upon which it feeds,—which tree is known to flourish on all kinds of soil and in widely different latitudes.

There are some interesting features in the natural history of this worm. The female deposits on an average, two hundred and fifty eggs.* These are about 1.6^{mm}. long, oval in form, and of a cream color (Fig. 16, *a*). They are spotted in places with dark green or black particles, which can be rubbed off and which under the microscope are found to consist principally of gum, mixed with minute hairs.

The moth fastens them by means of a gum with tolerable firmness to whatever object she may be upon. They are however easily detached, and if subsequently placed on moist cloth or paper will again adhere. They hatch at a temperature of 65° Fahr.

Within a month after hatching the worm (Fig. 16, *b*) spins up, forming its cocoon (Fig. 16, *c*) within the leaf which is drawn partly around it, and fastening the leaf stalklet to the main stalk with strong silk, In five days it becomes a chrysalis (Fig. 16, *d*), and if of the first brood, produces the moth within three weeks afterwards. The second brood of worms generally have the instinct to fasten their cocoons to the more permanent twigs, to which they hang securely during the winter; but they often attach them to the leaf stalk, with which they are carried to the ground in the fall; and the streets of the cities in which they have become wild are often strewn with such cocoons which get trodden on and destroyed.

The moth is of a rusty yellow color inclining to green, and marked with pale lilac and white, with transparent crescent spots. The males are smaller that the females, having smaller bodies and narrower wings, the hind ones, especially, being much less rounded. The male antennæ are scarcely any broader than those of the female.

The above descriptions are general in their character. The insect is not only variable in intensity of markings and coloration, but likewise, to an unusual degree, in the time required for development. In a number of them which we have had under close observation, some of the first that were bred were very irregular in this respect, part of the second brood issuing as moths in the fall, and part remaining over winter in the cocoon till the middle of the following June. The chrysalis has also remained not only through one winter, but throughout the summer, and succeeding second winter, and not giving forth the moth till the second summer though the cocoons were submitted to precisely the same conditions under which others hatched, from the same batch of eggs issued in the fall of the year in which they were hatched. This is the common experience of most persons who have raised the worms in large quantities.

A high temperature generally hastens their development, as it does in other insects; and while many of those of the summer brood average but 25 days from the time of hatching to spinning, those of the fall brood which issue the same year, average 30 days.

Some specimens which we happened to have feeding in 1869, in cages containing plum twigs as well as Ailanthus, seemed to eat the leaves of the former with as much relish as of the latter; and no doubt other food plants might be found for this insect, if it was desirable. In Europe they have also been fed with success on *Rhus coriaria* and Pimpernel; while Dr. Alexander Wallace, of London, has fed them with Plum and Laburnum, producing moths weakened and defective in size. He gives, in one of his papers, a very interesting account of some dwarfs produced from celery-fed worms.

The silk of the Ailanthus worm is no doubt very valuable, but to what extent, depends on our ability to manufacture it successfully. It has several disadvantages, but native ingenuity may devise some means to overcome them or turn them to account. The value of any silkworm depends on our ability to unwind its cocoon. The cocoon of this worm is prolongated and its threads are attached by strong and very

* Parthenogenesis has been known to occur exceptionally in this as in other species of the family. See *Annales de la Soc. Ent. de France.* 1872. LXII.

tenacious gluten, for which reason it has never been successfully unwound, and even carding is not an easy operation. Like that of our *Cecropia*, the Ailanthus cocoon is open at one end, and though the thread is continuous, and if disengaged of the glutinous matter which binds it, may be continuously reeled off, yet such reeling is rendered difficult from the fact that the moment the cocoons are placed in the basin they fill with water, sink to the bottom, and cause the threads to continually break.

There are some important facts connected with ailanthus silk which recommend it. It bleaches well, and has long been used in China, where it is known to be so durable that a dress made from it frequently descends as an heir loom for generations. It has for many years been in the markets of France, and specimens of manufactured stuffs from it, which we saw in Paris and London, took on sundry dark colors very well and looked remarkably fine.

This class of goods is known as *Ailantine*, and might be put to a great many uses, as there is always a demand for coarse silks. We have understood that specimens of this silk have been successfully woven at Paterson, N. J.

A number of devices for unwinding the cocoons have been patented in Europe, but none seem to have come into general use, and whatever impetus they may give *ailanti*-culture, we may rest perfectly satisfied that such culture will never become general, and that the *Ailanthus* silkworm will never replace that of the Mulberry.

The prime reason why the Mulberry silkworm must ever be THE silk producer of commerce, aside from the superior quality and quantity of its silk, is that it is a domesticated insect, and that the worm can be fed in large quantities in partial confinement and under control; further, that, while enduring this artificial life, it shows no disposition to escape from the shallow trays upon which it is fed. All the other worms suffer more or less when brought together in large numbers, or when confined or sheltered, and in this fact more than in any difficulty in using the silk, lies the secret of the failure to substitute any of them for *mori*. The hardiness and adaptability of *cynthia* to different climates cannot offset this objection; for it remains essentially a wild worm, and it will require many centuries of selecting and artificial rearing ere it can be domesticated to the same extent that is the *Sericaria mori*. There never can be any dependence placed on the production of silk from worms growing wild on their food-plants, as in such state their exposure to birds and other enemies will always render the cocoon harvest uncertain, and it is far more expensive and troublesome to protect both the wild worms and the trees on which they grow, than it is to rear the Mulberry worm by the ordinary methods employed.

The question of cultivating our *Attacus cecropia* is again being discussed in France. Its silk is less valuable than that of *cynthia*, and all the objections to this last apply still more forcibly to *cecropia*. The following conclusions which we came to in 1871,* after considering all the introduced and native silkworms of any importance, hold equally true to-day:

> There can be no good reason given why silk-culture may not become one of the industries of this country, especially if fostered at the start. We would, however, advise no one to enter into it on a large scale, as a business. The raising of silk is seldom lucrative, even in the most favorable countries; for in this as in most other industries, the principal profits accrue to the middlemen, reelers, and manufacturers; but on a small scale, and prosecuted in connection with other branches of agriculture and horticulture, it will give most desirable returns for the time employed. The erection of a few reeling establishments is absolutely necessary to establish this industry.
>
> For in-door culture, no worm surpasses the mulberry species (*mori*), for out-door culture none at present surpass the ailanthus species (*cynthia*), though if *yama-mai* and *pernyi* can once be acclimated, their cocoons are more valuable. Of the native worms *polyphemus* is the most valuable and important, its silk being easily reeled and of excellent quality: *cecropia* comes next in order, its silk being reeled with difficulty, while that of *promethea* and *luna* is of less value, has never yet been, and probably cannot be reeled.

The Hickory Scolytus (*S. 4-spinosus* Say), has recently been received from Wash. Ter., showing that this pest is more widely distributed than heretofore supposed.

* 4th Mo. Ent. Rep., p. 138.

AN UNRECORDED HABIT IN THE LIFE-HISTORY OF CERTAIN TRICHOPTEROUS INSECTS.

Mr. Salvin recently placed in my hands three leaves of hazel, upon each of which was a gelatinous mass, enveloping either ova or recently hatched larvæ of some Trichopterous insect; the bushes upon which they were found were situated at a considerable distance from the nearest stream. The ova in the still undeveloped mass were arranged in regular series, made still more evident by the two black eye-spots of each embryo, which showed both through the eggs and through the viscid surroundings. After the lapse of about twenty-four hours, the previously unhatched larvæ were roaming in their transparent environment, and some of those already hatched had left it, and were wandering about the box, probably in search of the element they were not destined to find, and their size had wonderfully increased since they were hatched.

Only a few days before this experience, Mr. Rye informed me that poplar leaves bearing similar gelatinous masses had come under his notice. This reminded me that Prof. Westwood had once either recorded, or mentioned to me verbally, quite a parallel case (I now believe it was a verbal communication); the accumulation of evidence appears worthy of notice in a more prominent manner.

The size of the gelatinous masses was considerable; undoubtedly large at the time of deposition, and increased by the absorption of moisture from the air. The juvenile larvæ appeared to me to belong to the Family *Limnophilidæ*, and, considering the time of year, I have little doubt they pertain to the genus *Halesus*, all the conditions agreeing therewith.

These observations open up more than one interesting problem in the early life-history of Trichopterous larvæ. *Halesus* is a genus the larvæ of which frequent streams. The larvæ hatched from the egg-masses collected by Mr. Salvin would have had to travel many yards before they reached the nearest stream, or water of any kind, save that resulting from recent rains. Furthermore, it appears to me that the gelatinous secretion in which the eggs are enveloped may serve as *food* for the young larvæ, otherwise it is difficult to account for the very considerable increase in size of those I had under observation, amounting in less than two days to about double that of the newly emerged larvæ.

All *Trichoptera* (so far as is known) void their eggs in a viscid surrounding. Most of them deposit this mass in the water or on water plants. In the case now under consideration it appears probable that certain of them prefer (either habitually, or casually) to avert immediate contact with the element in which their progeny must eventually pass the greater part of their lives, and to trust to chance that some of them may, at the proper time, reach their aquatic home.

There is mystery about the infantine life of most Trichopterous larvæ, notwithstanding that it was from observations on the eggs of a species of this Order that Baddach, in 1854, wrote a memoir that contributed greatly to the advancement of embryology in insects, a subject that of late years has become almost a distinct branch of natural science.—R. McLachlan, in *Entom. Monthly Mag.* (London), *Nov.* 1879.

INSECTS INJURING THE BLACK LOCUST

(*Robinia pseudacacia*).

BY V. T. CHAMBERS, COVINGTON, KY.

Farmers in Northern Kentucky are making many complaints about the injury that is being done to locust trees by insects. The principal depredators are the beetle *Hispa* (*Uroplata*) *suturalis* Fabr., both as larva and imago, and the Tineid larvæ of *Lithocolletis ornatella* Cham., *Lithocolletis robiniella* Clem. and *Gracilaria* (*Parectopa*) *robiniella* Clem. Many other insects feed also on the Locust; and it sometimes happens that a species which has been usually not very abundant, will suddenly become so numerous and commit such devastation as to become for the time a plague. For this reason I deem it best to refer briefly to the other insects which feed on the Locust, before referring further to the principal depredators above named. Thus

Ææa purpuriella Cham. is a leaf-miner of the Locust; that is, it burrows in the substance of the leaves between the upper and lower cuticles. Its mine is small and placed at the junction of a vein and the midrib, if this is indeed the work of this species, the history of which has not yet been sufficiently investigated. There is also a small larva which is sometimes found inhabiting a tube made of "frass" inside the mines of *Lithocolletis robiniella* and *L. ornatella*, and it is possible that this may prove to be the larva of *A. purpuriella*, as to the larval habits of which nothing can be said with certainty except that it feeds on locust leaves. *Gelechia pseudacaciella* Cham. is another locust-feeding larva, which when very young, may be found under a minute web which extends a little way along the side of the midrib on the under-side of the leaf, and later in life may be found feeding between two leaflets or inside of the mine of *L. robiniella*, the pupa of which it frequently eats. Dr. Packard mentions another larva, that of *Depressaria robiniella*, as feeding on locust leaves, but it is unknown to me. The larva of *Xylesthia Clemensella* burrows in the dead locust timber, and possibly also in the living wood, and there is a singular larva, the imago or moth of which is unknown, which burrows in locust twigs, eating the pith. Its jaws, head and thoracic segments are large and nearly black, and its feet are well developed; the abdominal segments are yellow, marked with spots like those many *Gelechia* larvæ, and the larva is about half an inch long. All of the foregoing species, except perhaps the last and *Hispa suturalis*, belong to the Lepidopterous family *Tineidæ*. Besides these the moth *Xyleutes robiniæ*, and the butterfly *Eudamus tityrus* also feed in the larval state on the Locust; the former boring in the wood, the latter feeding externally on the leaves. Besides the *Hispa* before mentioned, another beetle, *Clytus robiniæ*, feeds on or rather in the Locust in its larval state, burrowing in the wood. There are also some small *Homoptera* of the genus *Erythroneura* Fitch, which suck the juices of the leaves; but possibly the Locust may not be their only food-plant; and there are two species of *Diptera* (*Cecidomyia pseudacaciæ* and *Cecidomyia robiniæ*) which feed exclusively on locust leaves in the larval state. The first of these (*C. pseudacaciæ*) is not very abundant in this locality, but *C. robiniæ* is quite abundant and no doubt contributes to the destruction of the trees. It feeds externally on the leaves, causing them to curl and turn pale yellow over the affected part; but the burnt appearance which the trees present is not attributable to them, but to *Hispa suturalis*, *Lithocolletis ornatella*, and *L. robiniella* and *Gracilaria robiniella*. Prof. Haldeman, in the Pennsylvania Farm Journal, VI, mentions this appearance, and attributes it chiefly to *Cecidomyia robiniæ* and *Hispa suturalis;* but the two species of Lithocolletis and the Gracilaria were probably unknown to him, and their work was attributed to the beetle, which has sins enough of its own to answer for in this respect.

Locust groves are not so numerous in this region now as they were twenty-five years ago, but whether the insects above referred to have had anything to do with their decrease, I do not know. Their depredations only began to attract attention some ten or twelve years ago, and they have been on the increase ever since. By the 1st of August the groves look as if a fire had swept over them; and on examining the leaves in many groves almost every leaflet will be found to contain a "mine," as the burrow of the larva is technically called, and many of them will contain three or four; while the imago or mature insect of *Hispa suturalis* will be found in great numbers feeding externally on the leaves. The mine of this species is a large blister-like spot of a brown or grayish-brown color, and the larva contained in it is somewhat flattened, and has large jaws as compared with the other leaf-miners found in the same leaves, and it passes the pupa state in the mine. The mine of *Lithocolletis ornatella* is a flat, pale yellowish blotch, and the larva up to its fifth stage is whitish, flat, and small; after that time however it becomes green and more cylindrical. It leaves

the mine to pupate. The larva of *L. robiniella* like that of *L. ornatella* is found in both surfaces of the leaflets, and is what is technically termed a tentiform mine,—that is, it is a large white blister-like spot. Its larva up to its third stage is flat and white, and after that becomes cylindrical. The larva of the beetle is much larger than either of those of *Lithocolletis*. The fourth mine is that of *Gracilaria* (*Parectopa*) *robiniella*. It is pale yellowish and extends along the midrib on the upper side of the leaflet, sending off finger-like processes on each side. The larva is somewhat depressed, by which fact it may be distinguished from the larva of *L. robiniella*. These larvæ of *Lithocolletis* and *Gracilaria* have each only six legs ; but in their mines, and especially in the mines of *L. robiniella*, may frequently be found a larger, striped larva with eight legs ; this is the larva of *Gelechia pseudacaciella* before mentioned.

Fully nine-tenths of the depredations of insects on locust trees in this locality are the work of *Hispa suturalis*, *Lithocolletis robiniella*, *L. ornatella*, *G. robiniella* and *Cecidomyia robiniæ*, and probably one-half of it is the work of *H. suturalis*.

When we look at a grove in August the wonder is not that it should be destroyed by these depredators, but that it does not succumb much sooner than it does. It will continue to live, in spite of its injuries, for several years, the trees gradually dying out one by one. The young trees seem to suffer most, as the insects seem to prefer their foliage ; and large old trees seldom exhibit the burnt appearance of the young groves. Young shoots growing up around an old trunk will sometimes have nearly all their leaves blistered, while but few comparatively of those on the old tree will be injured.

No means of checking the ravages of these species are at present known, other than those afforded by nature, and these seem wholly insufficient. I have bred two species of Chalcid parasites from *L. robiniella*, and two from *L. ornatella*, and one from *Gracilaria robiniella*, and there are also parasites which prey upon *Hispa suturalis;* but although these parasites are abundant they are not numerous enough to check perceptibly the devastations of the leaf-mining larvæ. Economic Entomology may and it is to be hoped will accomplish much in the future ; unfortunately, man is at present very much at the mercy of his contemptible little foes.

THE INSECT ENEMIES AND DISEASES OF OUR SMALL FRUITS.

[Read before the New Jersey State Horticultural Society, Jan. 16, 1880, by A. S. Fuller.]

Insects and diseases are frequently so closely united, or so dependent upon each other, that the naturalist often finds it difficult to determine to which the fruit-grower should attribute his losses. Some species of insects attack only diseased or dead plants ; others only the living and healthy. If a plant shows signs of failing we are inclined to speak of it as being diseased, whether the failure is caused by a lack of some element in the soil, attacks of parasitic fungi, or noxious insects. The loss is the same in the end, whether from one or all of these enemies combined.

There are two practical methods of combating insect enemies and diseases of plants ; one is to so carefully cultivate and stimulate the growth of the plants that they may possess the power of resisting attack ; the other is to make war directly upon them by artificial means. Of course, the first method is most applicable or practicable against the more minute species, such as the plant-lice, rust, smut, and mildew. I do not recommend forcing plants to extremes, in order to enable them to resist their enemies, as this might work an irreparable injury ; but the condition to be aimed at should be a healthy, vigorous growth ; for anything beyond this, is more the sign of weakness than strength.

The half-starved, over-worked, and uncared for horse is sure, sooner or later to become the prey of various kinds of internal and external parasites, which are thrown off, or their attacks successfully resisted by the healthy, vigorous and well fed animal ; and the same principle holds good all

through the animal and vegetable kingdoms—whether the subject be a man, horse, sturdy oak, or delicate strawberry plant. Not that all diseases are due to loss of vigor through starvation and neglect; but that a large number of them are, is well known.

The experience of the grape-grower of France with the Phylloxera is one of the most remarkable instances on record of the success of what may be termed the "resistant methods" of combating insect enemies. After having searched in vain for many years to find some practical method of destroying this pest, Prof. Riley in his remarkable investigations in this country discovered that some of our native American varieties were capable of resisting it, *i. e.* of growing vigorously notwithstanding the presence of the lice upon their roots. This discovery opened a way out of the difficulty, and the French are successfully availing themselves of it by using our resisting species as stock for their more susceptible kinds. The Grape Phylloxera is more or less abundant in all of our vineyards, but owing to the rapid and vigorous growth of most of our native varieties it does comparatively little harm.

But we have many kinds of insects that attack our small fruits that cannot be controlled upon this resistant system, and we are compelled to combat them in a more direct and vigorous way, and among the first to which I would call your attention are those

AFFECTING THE BLACKBERRY.

Some ten years ago, the cultivators of the Blackberry in various parts of New Jersey noticed that the ends of the young growing canes in summer would occasionally curl, twist about, and often assume a singular, fasciated form, resulting in an entire check to their growth. The leaves on these infested shoots did not die and fall off, but merely curled up, sometimes assuming a deeper green than the healthy leaves on the same stalk. At the approach of winter the infested leaves remained firmly attached to the diseased stems, and all through the cold weather and far into the spring, these leaf-laden and diseased stems were a conspicuous object in many of the blackberry plantations of this State.

If the infested shoots are examined in summer, thousands of minute insects of a pale yellow color and covered with a powdery exudation will be found sucking the juices of the succulent stems and leaves, causing the crimping, curling, and twisting of these parts as described.

This parasite resembles somewhat an ordinary green-fly (*Aphis*) or plant-louse, but according to the observations of Prof. Riley it belongs to the closely allied Flea-lice family (*Psyllidæ*), distinguished from

[Fig. 17.]

PSYLLA TRIPUNCTATA—hair line showing nat. size (after Riley).

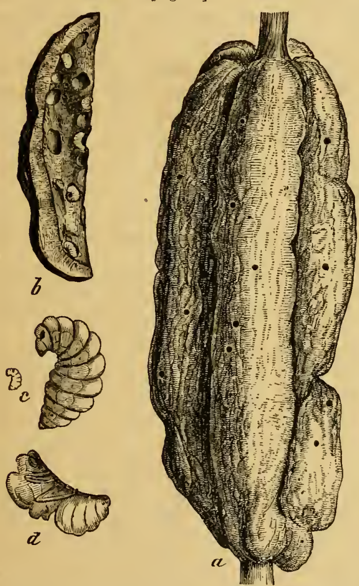
the plant-lice by a different veining of the wings, and by the antennæ being knobbed at the tip, like those of the butterfly, the knob usually terminating in two bristles. These insects jump as briskly as a flea, from which characteristic they derive their scientific name. The particular species in question was called by Prof. Riley the "Bramble Flea-louse (*Psylla rubi**)" in the American Entomologist (Vol. I, p. 225). It has increased very rapidly during the past half dozen years or more, and unless fruit-growers make a more vigorous fight than they yet have done, it will soon get the mastery of most blackberry plantations. The only practical method as yet discovered for checking the ravages of this insect, is, to cut off the ends of the infested canes and burn them. This operation should always be performed either in the morning, or during cool wet weather, else many of the insects will escape, and at all times the severed shoots should be im-

* It cannot be distinguished from *Psylla tripunctata* Fitch (Catalogue of Homoptera, etc.), and, what is most singular, the same species is very common on Pine trees all over the eastern part of the continent, from Florida to Canada.—Ed.

mediately dropped into bags and in them carried to the place where they are to be burned, and there emptied into the fire. If every one having blackberry bushes in their gardens would practice this method of destruction, this pest would soon cease to do much harm.

Several species of Borers infest the Blackberry: the most common one is the larva of a small, slender, red-necked beetle, the *Oberea perspicillata* of Haldeman. The small, legless grubs bore the pith of the canes, causing them to die prematurely, or so weakening them that they are broken

[Fig. 18.]



DIASTROPHUS NEBULOSUS: *a*, gall; *b*, slice of same showing cells and grubs nat. size; *c*, larva; *d*, pupa—enlarged (after Riley).

down with the wind. As there are some fourteen or fifteen species of the *Oberea* now known, it may be that more than one species breed in the Blackberry. Thus far however I am not aware that they have been very injurious, but it would be well to gather all infested canes and burn them with their contents.

The Blackberry is subject to the attacks of several species of gall-insects. A fuzzy, prickly gall on the twigs is produced by a four-winged fly (*Diastrophus cuscutæformis* O. S). Another species of the same genus (*Diastrophus nebulosus* O. S.) produces a large pithy gall on the canes, but both of these gall-makers have very formidable parasitic enemies which keep them in check. There are also a few leaf-eating beetles, slugs and caterpillars, that sometimes attack the Blackberry, but they are seldom sufficiently numerous or injurious to attract much attention. The larger species are readily destroyed by hand-gathering, and the smaller ones can usually be driven off by dusting the plants with lime.

The most formidable enemy however of both the Blackberry and Raspberry is what is called the Orange-rust (*Uredo ruborum*). It is perhaps more abundant on the Black-cap raspberry (*Rubus occidentalis*) than on the ordinary varieties of the Blackberry; still it is sufficiently abundant and destructive to all to attract the attention of horticulturists throughout the country. I do not know of any remedy except to stamp out the disease by rooting up every affected plant and burning it. It may be that applications of lime, salt, or some similar substance would check the disease, and while these may be safely tried as preventive measures, the destroying of all infested plants should not be omitted.

(*To be continued.*)

THE RELATION BETWEEN INSECTS AND PLANTS, AND THE CONSENSUS IN ANIMAL AND VEGETABLE LIFE.*

BY LESTER F. WARD, A. M., WASHINGTON, D. C.

The object of this paper is rather to show the importance of a more connected study of these two great departments of Natural History than to present new facts in either of them. The prevailing practice of isolating them and carving out of each a number of exclusive specialties, while it is necessary and advisable within certain limits, nevertheless allows, when universally followed, a large class of important

* This paper, read at the St. Louis meeting of the A. A. A. S., was placed in our hands in the Fall of 1878 when we expected to commence the publication of the *Entomologist*, and with the author's permission has been held by us since that time.—ED.

phenomena lying on the border-land between them, to escape entirely.

It is an old truth that many animals subsist on vegetables. It is a newer truth that all animals depend altogether, either directly or indirectly, upon plants. It is a still newer truth that many plants are partially or wholly dependent for their existence on certain animals.

The power of plants to manufacture protoplasm and starch has no parallel in animal physiology. Viewed from their relations to the inorganic world plants are producers while animals are parasites.

True, there are organisms which, from morphological considerations, are called plants, but which are also parasites. And there are other organisms which have been and still are called animals, but which originate organic matter. But these are only illustrations of the difficulty in attempting to preserve popular names which were applied to things before science had taught us the nature of the things themselves. And this question of names is still further complicated by cases in which both functions are performed by the same individual. We may remand *Volvox* and the *Bacteria* to the vegetable kingdom and the fungi to the animal, but what shall we do with the mistletoe, the pine-sap, and the broom-rape? The terms "animal" and "plant" do not express the fundamental distinction which nature makes between the two departments of life; and when we attempt to define that distinction by saying that the true vegetal function is *chemical* while the true animal function is *physiological*, the terms thus employed must be taken in a special scientific sense and not in the popular acceptation. Giving them this sense we can correctly say that there are large groups of organisms in which both animal and vegetal functions are performed by the same individual, whose reference to the one or the other of the two kingdoms is a pure matter of convenience, to be determined chiefly by morphological considerations. Still clinging to our definition, we may also correctly declare that all animals subsist exclusively on the products of vegetation. They are parasites in the highest sense, fully installed parasites, the respectable ruling classes, who never think of work. The so-called parasitic plants, on the other hand, are degenerate tramps who combine a little drudgery with much *unsystematic* plunder, thus rendering themselves unpopular. And it may be generally stated that the tendency of all life is to escape this drudgery of organic production wherever an opportunity presents itself, and this it does even where great degeneracy is the necessary result.* I certainly need not point out here the parallel between the two great sciences of Biology and Sociology.

Leaving these general considerations relative to the fundamental dependence of animal upon vegetable life, I propose to call attention to some facts of a more practical nature coming under the same head.

It is of course chiefly as food that animals appropriate plants; but there are many and varied ways in which this takes place, and the extent to which certain animals are nourished by certain plants exerts a great influence upon both the floras and faunas of the various regions of the globe, thus bearing directly upon the problems of geographical distribution. The introduction of a new animal into a region in which it did not previously exist often so greatly alters the vegetation in a few years that it would scarcely be recognized. Such an effect has been produced in South America by the introduction of horses which have become wild and now roam in great numbers over the pampas. And even small animals produce effects which seem quite out of proportion to the cause. The operations of man in changing the face of Nature, when scientifically viewed, constitute an illustration of the same truth. Of all the migratory animals man exerts the most profound influence upon the flora of the globe. He not only exterminates certain species and fosters others, as do other

* Ernst Haeckel, Ueber de Individualität des Thierkörpers, pp. 10, 11.

animals, but, by a system of artificial selection which he to a great extent unconsciously practices, he effects the most extraordinary modifications in the plants themselves, illustrations of which it would be quite superfluous to adduce.

When to these considerations we add those arising out of the relations which insects sustain to plants we are brought face to face with the most practical questions of horticulture and agriculture, a thorough acquaintance with which is of the utmost importance. To this same group also belongs the extensive subject of *galls*. This study is essentially compound and belongs to botany as well as to entomology. The gall presents a case in which, in the normal condition, the plant is the loser, yet there is reason to believe that such is not universally the case. The whole subject has been so exclusively given over to the entomologist that it may be safely predicted that whenever it shall be phytologically studied much valuable knowledge will be added to that already acquired. Plants are not generally killed by the bite of the insect. This would defeat the end the insect itself has in view. The normal channels of circulation and growth in the plant are simply blocked up and forced to re-form under new conditions favorable to the insect. The case is analogous to those in which man turns the channels of streams to his own advantage or in any manner diverts the forces of Nature in his own favor, which is the essence of invention and of all material progress. In neither case is Nature actually defeated, it is only controlled. In the gall the insect has learned to control the forces of growth to its own advantage.

Where the same insect operates in the same manner upon the same plant for many generations a certain adaptation must take place. The abnormal mode of growth must become to a certain extent normal. We may even suppose cases in which the presence of the gall has come to be a benefit rather than an injury. I have myself observed many cases in which it appeared in no way to arrest the normal function of the plant. Specimens of *Eupatorium album* recently collected exhibited a swelling in the peduncle at the base of each head, in the center of which was a hollow cavity enclosing the larva. But the tissue all round this cavity seemed perfectly healthy and the flowers were in all states of advancement and apparently wholly unaffected by the gall. A remarkable gall which I found on the prevailing juniper of the Wasatch range, *Juniperus Californica*, var. *Utahensis*, deceived everybody but professional naturalists by its resemblance to fruit, and though abundant in certain localities, did not seem in the least to impair the growth of the trees. Oak galls, as all know, are green; they contain chlorophyl and must perform the regular functions of assimilation. The insect producing a gall may be regarded as a parasite on the particular plant chosen whose growing tissue the larvæ usually devour at something near the rate at which it forms. There are cases both where plants are parasitic on plants (e. g. lichens on fungi*), and where animals are parasitic on animals,† in which the foster individual is benefited, and that such should sometimes be the case with plants regularly affected by the same gall is not antecedently improbable.

With these few remarks on the first general division of the subject or that in which the dependence of animal life upon plant life is shown, we may now pass to the second division which includes the evidence of a reciprocal dependence of the plant upon the animal.

That quadrupeds and birds are perpetually conferring great service upon many forms of plant life there is now no doubt. This is done chiefly in securing their proper distribution over the earth. Were the seeds of plants compelled to depend upon gravitation and the winds alone for their distribution the relative proportions of the various species would be very different from that which we actually find. In many cases the seeds, berries, and nuts,

* Sachs, Lehrbuch der Botanik, p. 330.

† Van Beneden, Animal Parasites and Messmates.

falling directly to the earth, would spring up in such dense clumps as to choke each other and endanger the life of all. Every species has to pass through a certain ordeal in the history of its struggle for existence, at which period any, even the smallest, additional obstacle to its progress is sufficient to turn the scale against it and force it to succumb. It is at this time that a wide distribution is of the greatest advantage. With most of the choicest nut and fruit bearing species this is the case, and had no other agency existed for accomplishing this purpose than those of inorganic nature it is doubtful whether they could have survived. This great service is performed by animals and by birds in a variety of interesting ways.

The full significance of the many remarkable kinds of fruit can only be understood by recognizing this principle. But it must also be remembered that the adaptation has been mutual. We cannot assume the various fruits to have first existed and that afterwards the animals and birds came upon the stage and accomplished their distribution. The development of both has gone on *pari passu* from the beginning, and this also harmonizes in a suggestive manner with the known simultaneous geological appearance of these higher forms of vegetable and animal life. Under the law of natural selection, now the fundamental principle of biological dynamics,* berries and fruits have gradually acquired attractive dimensions, tastes and colors,† while the true germinal portion, (seeds, drupes, &c.) have been protected from destruction in various ways, and thus the animal world has been employed to distribute the vegetation, for which labor it receives its own subsistence as a remuneration. Not always, however, is compensation thus meted out, for in the many kinds of burs, by whose aid the plant is equally benefited, the task of distribution is an involuntary and unwelcome one to the creature performing it.

But interesting as these considerations are, and pointedly as they show the intimate connection subsisting between the physical life of animals and plants, they are nevertheless trite, in comparison with the astonishing facts which a study of insect life in its relation to plants reveals.

Whether it be true or not, as queried above, that plants may in certain cases derive benefit from insects through the agency of galls, it is now certain that they do derive such benefit in at least two other entirely distinct ways; viz.—1: by the action of the insects in cross-fertilizing flowers; and 2: by the action of plants in entrapping insects and appropriating them to their own nourishment.

Considering the first of these modes, that of cross-fertilization, it is surprising to what extent the evidence already obtained, and that by comparatively few observers, supports the conclusion that for the higher forms of vegetation this reciprocity is one of equality, and that the vegetable kingdom is as absolutely dependent upon the animal as the animal is upon the vegetable. This fact of insect agency in cross-fertilization which Sprengel, its original observer, appropriately styled "The newly-discovered Secret of Nature," has been so far established and extended by recent observation that it has become the key to the greater part of the mysteries of vegetable morphology. In fact it has so enlarged our conceptions of the science that the peculiarities of structure observed in flowers are no longer looked upon as positive facts (I use the term *positive* in the Comtean sense) but as effects, and we at once proceed to interpret their significance and determine their true cause or *raison d'être*. Just as when the archæologist discovers a singular vessel or implement he refers it to the agency of an intelligent being who must have constructed it, so the modern botanist, when he sees a curious structure in a flower, proceeds by a course of rational deduction to account for it as

* That department of biology which takes account of the changes that have taken place and which are constantly taking place in the form, habits, location and numerical relations of living things.

† In *Medeola Virginica*, the Indian Cucumber-root, I have suspected that the brilliant red color of the upper whorl of leaves which accompanies the ripening of the berries located at its base, may have been developed through natural selection for the attraction of birds.

the result of insect agency. The parallel, however, holds only so far. The manner in which the result is produced, as also the motive of the agent, being widely different in the two cases.

New facts are being continually added to prove the extent of this influence. There is scarcely a flower in our woodlands or meadows whose attentive study does not teach us something of it. Upon them all these tiny creatures have impressed their stamp. It is now extensively maintained that all that makes flowers attractive to us, their brilliant hues, their fragrant odors, as well as their size and form, are the fruits of the industry of the insect microcosm as slowly brought about through ages of time That celebrated couplet in Gray's *Elegy written in a Country Churchyard:*

> "Full many a flower is born to blush unseen,
> And waste its sweetness on the desert air,"

was the product of the knowledge of the 18th century and is no longer true. Showy and fragrant flowers are the consequence of a true psychic force, of an æsthetic faculty identical with that of man, and our admiration of them simply proves that we admire what the insect world admires, and that there is a standard of taste which holds not only for mankind but for all sentient beings.

(To be continued.)

THE COTTON WORM.

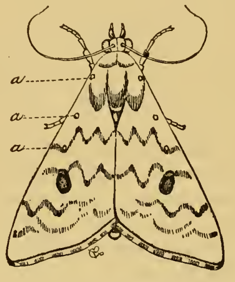
HABITS AND CHARACTERS OF THE MOTH OR IMAGO.*

The moth measures from 1⅛ to 1½ inches from tip to tip of wing when these are expanded. Its general color, above, is olivaceous, more or less effectually subdued by lilaceous or purple hues, and often having a clay-yellow, or faintly golden cast. The under-side is more gray, with nacreous reflections.

The markings that more particularly characterize and distinguish it from all other North American moths are certain undulating vinous or carmine lines across the front wings, a dark oval spot near their disc containing pale scales, which usually form a double pupil (the basal or inner one the smallest and whitest), *and three white specks dividing the space between this dark spot and the shoulder in about three equal parts.* (Fig. 19, *a a a.*)

The sexes are not readily distinguishable, as the relative stoutness of the male

[Fig. 19.]



OUTLINE OF ALETIA: showing characteristic marks and white specks (*a a a*)—twice natural size (after Riley).

antennæ compared with those of the female is so slight as to be no safe guide. An examination of the tip of the abdomen, especially from the side, will always show the difference, however, the last joint in the male (Fig. 20, *a*) being the longer and more full, and the pale tufts of hair that belong to the withdrawn genitalia* showing within or beyond the squarely docked tip; while in the female (Fig. 20, *b*) this joint is shorter, more pointed, and obliquely truncate beneath.

The habits of this moth can only be studied at night, as, like almost all the rest of its family, it is nocturnal. During the day it simply starts up when disturbed, and darts by swift and low flight to some other sheltered spot a few yards, or perhaps rods, away. After sunset, however, it may be seen leisurely hovering about, either bent on the perpetuation of its kind or feeding upon whatever sweets it can get, whether from the cotton or from other sources. It is very strong and swift of wing, and capable, when the necessity arises, of flying long distances. In alighting upon the plant it

* From Bulletin 3, U. S. Entomological Commission, by C. V. Riley.

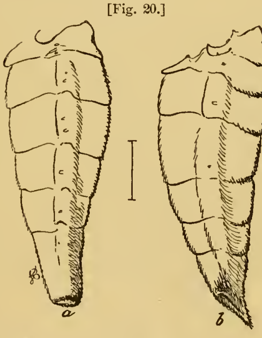
* The male genitalia in this species are remarkable for having two extensile organs, usually retracted and showing as dense tufts of hair, but capable of extension to thrice the length of the rest of the armature; also for two attenuated double-jointed spines which lie when at rest in a sheath on one side of the penis with the points extending beyond it, but which in action bend back at right angles therefrom.

generally turns its head downward, and when it rests, the wings are but shallowly roofed, the front ones closed along the back and fully hiding the hind ones. In this respect it may always be distinguished from the parent of the Boll Worm, which rests with the front wings partly open and not entirely covering the hind ones.

The female begins to lay her eggs in from two to four days after issuing from the chrysalis, the time varying with the different generations and according to temperature.

In experiments which I have made with moths confined in vivaria, eggs have sometimes been laid thirty-six hours after issuing, and the moths have continued laying for twenty-one nights, the number laid each night ranging from 4 to 45.

[Fig. 20.]



COTTON MOTH: *a*, male abdomen; *b*, female do.—enlarged (after Riley).

Examination of the ovaries of females at different seasons shows a much greater prolificacy than belongs to most moths, as the number of well-developed ova may reach 500, and of potential ova half as many more. In confinement it is difficult to obtain from one female more than 300 eggs, but that fully double this number are produced in the field during the height of the season there can be little doubt, while the average number may be estimated at about 400.

The natural food of the moth, as first shown by me in the fall of 1878,* is the sweet exudation from the glands upon the midrid of the leaf and at the base of each lobe of the involucre of the cotton plant. Nevertheless it is attracted to all kinds of sweets, and in most parts of the South it finds a bountiful supply in the exudation from the spikes of *Paspalum læve*, a tolerably common grass, but particularly in that copiously secreted by glands at the apex of the peduncle, just above the pods of the Cow-pea (*Dolichos*). In the spring of the year, as Judge Bailey of Marion, Ala., has observed, it may often be seen in the evening feeding in numbers, first from the blossoms of the Chicasaw plum, and subsequently from those of the peach, Chinese quince, mock orange (*Cerasus carolinensis*), the early apples, and blackthorn. Later in the season, when the glands above mentioned begin to exude and the tree blossoms are no more, the moths do not seem to be attracted by other nectar-storing flowers, since observations during the past two years by myself and assistants have resulted in finding but one species of verbena (*Verbena aubletia* L.) frequented, even where both moths and all sorts of flowers were abundant. But fruits of all kinds as they ripen are resorted to, and figs, apples, peaches, plums, apricots, grapes, persimmons, and even melons are often greatly injured.

Carefully examined, the tongue is seen to be armed along its terminal half with stout and sharp spines projecting forward from the upper surface and increasing in density toward the tip, which is beset with them on all sides. It is by means of this spinous tip of the tongue that the moth works a hole in these fruits, and is thus enabled to absorb the more liquid portions. Apple pomace is especially attractive to them.

* See *Atlanta* (Ga.) *Constitution*, September 20, and *Scientific American*, November 15, 1878.

As illustrating the remarkable tenacity of life possessed by some Snout-beetles, Mr. C. O. Waterhouse of London, mentions that a Curculionid (genus *Cleonus*) after resisting the action of Laurel-leaves, was twice immersed in benzine, the second time for one whole night, and finally had to be killed by hot water.

BIRDS vs. INSECTS.

BY M. EDOUARD PERRIS.*

[The following paper is of interest, not only for its originality and ability, but because the condition of affairs portrayed therein is very closely paralleled in this country at the present time. Here, as in Europe where this paper was written, the question of the food of birds—almost entirely a question for entomologists and botanists—has been generally ignored by these and left almost wholly to the ornithologist alone. Consequently, public opinion, whether really right or wrong, has certainly an insufficient basis, and is therefore liable to be shaken or even materially modified, on insufficient grounds. It is partly with the hope of calling the attention of our economic entomologists to a line of investigations which, although not conclusive, is nevertheless indispensable to correct views of this difficult subject, that this article of M. Perris' has been translated.—S. A. F.]

For several years it has been quite the fashion to speak extremely well of the birds, and to extol the services which they render to agriculture by destroying insects injurious to the products of the soil. Their eulogy is found in a multitude of books, memoirs, reports and notices, even the names of which I should vainly attempt to give. Agricultural, scientific and literary societies; general councils and legislative assemblies, have resounded with their praise. All the world seems to have put itself in tune for a universal concert, which has been undisturbed, hitherto, by a single discord.

A conviction of the usefulness of birds has naturally given rise to the idea of protecting their lives; an uprising has occurred against their pursuit by hunters and against the instruments used in their capture; those who destroy their nests have almost been given up to public execration; even the Senate has been besought to take measures for their protection; and a grave and learned senator, acting in good faith and with an eye to the general interest, has embodied, in a remarkable, formal report, the current charges against hunters and birds-nesters, and the public feeling in favor of their victims.

The government has been moved to action. At its request, the Institute, after dividing France into several zones, has prepared for each of them a list, more or less exact, of the birds which are resident there,—that is, of those which breed within the zone,—and of those which appear there only during the migrations. This list has been made the basis of instructions issued to the prefects, requiring them to authorize, in their respective departments, the pursuit of birds of passage only, and to forbid the taking of resident species;—as if the migrants of one country were not the residents of another, and as if it were reasonable to permit the south and centre to destroy birds useful to the north. They are also recommended so to restrict the methods of hunting as only to allow, for example, the capture of certain species, with snares of a single hair;—as if snares selected their prey, and as if this were not the most destructive of all methods of capture.

Does this feeling in favor of the birds, now so fully developed in France, prevail in other countries to the same degree? I believe that it is manifested nowhere with so much warmth and unanimity as among us. While we commend the birds as protectors of our harvests and tax our ingenuity to supply them with means and inducements for nesting near our dwellings and growing crops, the Egyptian agriculturist stands guard over his fields to drive them away. The peasants of Lombardy prepare nesting-places for the sparrows and then destroy the nests; and a great part of Spain is treeless only because the agriculturists of that country, obedient to ideas as exaggerated as our own, refuse either shelter or cradle to birds, from which they anticipate more injury than benefit.

In fact, the feeling of which I have spoken has not always been what we now find it. Until a few years ago, while the fact was generally recognized that a few birds are useful to a certain extent and that it was to our advantage to respect these, there was a disposition to believe that the protection of crops against insects depended on the agriculturists themselves, who, by combining their efforts, by acting simultaneously against the common enemy and by employing certain substances placed

* Translated by Prof. S. A. Forbes, from the *Bull. Menuel de la Soc. d'acclimatation*, Nos. 8-12, X, 1873.

at their service by science or empiricism, could drive away or destroy the devastators of their fields and save their produce. But it was finally seen that it is very difficult, if not impossible, to secure the necessary united action from all the cultivators of a country. In nearly every case it became evident that the war waged by man against insects is a most unequal one ; because they have on their side the advantages of numbers, minuteness, agility, nocturnal habits, means of concealment, and often a prodigious fecundity. Consequently, under the burden of an impotence more and more apparent, men have felt the need of seeking elsewhere the relief they did not find within themselves. Thus, very naturally, they thought of the birds. They noticed that the number of birds seemed to be diminishing,—doubtless because of the relentless pursuit to which they were subjected ; and they declared that the number of injurious insects had notably increased, since their ravages became more and more conspicuous,—a fact which I attribute to the extension of agriculture, to the increase of certain cultures —especially artificial and natural meadows —to various causes difficult to appreciate, and finally to a greater tendency to the observation of facts. Men saw a necessary connection between these two ideas, and said, "Insects are increasing because birds are diminishing ; then we will protect ourselves against the former by protecting the latter."

Men of authority in agricultural science gave currency to this idea ; it was corroborated by an honorable savant, M. Florent Prevost, connected with the Paris Museum of Natural History, who demonstrated, by dissecting the stomachs of birds, that many of these creatures live upon insects ; and from all sides, even from highly intelligent men, even from the midst of the gravest scientific societies,—those least subject to impulse—the cry arose, "Protect the birds, destroyers of noxious insects and benefactors of agriculture !"

Thus this clamor has arisen and expanded, increased by multitudinous echoes, and given origin to numbers of books and memoirs, in which it is related that the Chaffinch eats caterpillars, that the Sparrow consumes cockchafers, that the Goat-sucker devours night-moths, and that the Nightingale catches flies.

In the midst of this concert, the harmony of which nothing has yet come to trouble, may I dare to raise a discordant voice? I decide to do this, encouraged not by a presumption which is very far from my character, but by considerations which, it seems to me, are not without some value.

In the first place, I believe that I have one advantage over those whose opinions I oppose, which I mention, not through vanity, but because I am compelled to state it in order to secure some confidence ; it is that, addicted passionately, for more than thirty-five years, to the study of natural history, I find myself acquainted not only with the habits and mode of life of the birds of my country, but also with the habits of insects, which have been the favorite object of my studies.

This double knowledge is indispensable to enable one intelligently to appreciate the relations which exist between birds and noxious insects ; for the question is not whether birds eat insects—that is a fact of general notoriety,—but whether or not they destroy many *harmful* insects. Now M. Florent Prevost himself, although so generally deferred to in this matter, and so worthy of deference when he treats of birds, is powerless to solve the capital question which I have just asked, because he is not acquainted with entomology. When, for my own enlightenment, I applied to him for information on this subject, giving my reasons for attaching great importance to it, he maintained a silence which a common friend explained as due to his embarrassment.

In the second place, I have devoted myself, for a good many years, to quite careful observation, and have collected a sufficient number of decisive and incontestable facts to warrant me in forming an opinion and to assure me that I am in a condition to justify it.

In the third place, I am convinced that the current ideas respecting the utility of birds are prompted by impulse rather than reflection, and I believe that, if more attention had been paid to the rôle played by insectivorous birds and to the mode of life of the insects which injure us, very different conclusions would have been reached.

Further, I have tried this experiment, more than once. In conversation with learned entomologists, I have asked the simple question whether insectivorous birds are useful to agriculture. They have never failed to answer in the affirmative,—so plausible is the apparent logical relation between these two ideas :—birds living on insects and consequently protecting agriculture, which suffers so much from insects,—so powerful is the influence of a generally accepted opinion. And then, when I have asked them to reflect upon this relation, and have interested them in the investigation which I shall presently take up, they have very soon stopped me to say that they had been wrong and that I was right. Such are the considerations which determine me to contradict so many affirmations which no one has hitherto opposed. In doing this I have no intention whatever of furnishing a weapon against those who blame and would prevent the excessive destruction of birds. I deplore as much as any one the abusive pursuit to which they are subject ; I deeply regret the diminution of the songsters which impart so many charms to our groves and forests, the hosts which animate our fields, gardens and orchards, and bring gayety into our very homes. I observe with sorrow the decrease of game, which affords at once useful and agreeable recreation, and an important alimentary resource. It is not against the birds that I write, my sole end is to destroy what I believe to be an error and to establish what I believe to be the truth.

Nearly all birds, perhaps quite all, eat insects. Birds of prey, even, when famished, accept this last resort ; as do also, according to M. Florent Prevost, the Wolf, Fox and Badger, when their hunting has been unlucky. There are birds, such as Swallows, Martins and Goat-suckers, which live exclusively on insects ; others, like the Nightingale, Linnets and, generally, those known as Warblers (*bec-fins*), which habitually consume insects, and only vary from this habit in the latter part of the season by eating berries, figs, etc. ; others, such as the Chaffinches, Goldfinches and Sparrows, which prefer insects to seeds when they nourish their young ; but which the remainder of the time, like seeds better than insects. Others, the Wood-peckers, for example, are omnivorous ;—insects, worms, larvæ, seeds, fruits, little birds and young chickens, everything is good for them. Finally, not to prolong this list,—very far from complete—the rapacious birds, such as the Owls, Buzzards and Kites, more disposed to live upon flesh, sometimes content themselves, in despair of anything better, with game less succulent and less appropriate to their tastes.

From this very succinct and very incomplete summary (which each can complete for himself), it follows, that considering the great number of birds, a prodigious daily destruction of insects occurs. We must compute, not by thousands merely, but by hundreds of thousands or by millions, according to the area included in the estimate, the number of victims consumed during the summer, from one sun to another. The imagination is appalled at the idea of the total reached at the end of the year. It will be seen that I conceal nothing, but do justice at the start to those who proclaim the utility of birds. We must be truthful above all, but we must be truthful to the end ; and in our pursuit of the actual, we shall find their calculations notably compromised. Beyond a doubt, then, an incalculable number of insects become the prey of birds ; but *how many of these insects are injurious ?* Evidently this is the whole question, for no one would dream of resting the utility of birds upon the destruction of insects which are completely indifferent to our interests. This, then, is the question which we must elucidate and resolve. By nox-

ious insects I understand those which annoy man or the useful animals, those which cause real injury to industrial or alimentary plants, and, in a word, to all vegetables, large and small, which are of service to man or animals; those which, endowed with that marvellous but dangerous instinct which enables them to discern the morbid condition of shrubs and trees, help to hasten their ruin and often render it inevitable. But I do not place in this category the greater part of those which attack vegetables only when they are decisively dead, or those which content themselves with the destruction of a few leaves of the vine, the Hazel, the Currant, the Poplar, the Elm, the Oak, etc., and leave only inappreciable traces of their existence. In short, I include only those which there is some serious reason to fear. Let my exclusions be limited to any desired extent under the pretext that a species indifferent because comparatively rare may become common enough to be injurious, and, notwithstanding this concession, I shall establish the following calculation,—which can evidently be only approximate.

There exist in Europe about 14,000 known species of Coleoptera, 500 species of Orthoptera, 1,000 species of Neuroptera, 5,000 species of Hymenoptera, 2,000 species of Hemniptera, 6,000 species of Diptera, 4,000 species of Lepidoptera, and 2,000 species of Aptera. This makes a total of 34,500 species. Of this number there are at the farthest 350 species truly noxious or capable of becoming so. The others are without interest, from the point of view which we occupy, or, perhaps, useful, because charged with the destruction of our enemies, or designed to restrain the multiplication of parasitic plants. So that, taking into account the number of the species, we see that, of 100 insects taken by birds, an average of one may be injurious; of the 99 others the greater part signify very little to us, and a certain number have a mission of usefulness. All this seems singularly to diminish the beneficent rôle of birds. But, it will be said, it is not exactly upon the number of species that the calculation should be based, but upon the number of individuals, for it may be that noxious species are much more numerous in individuals than others,—the vine-grub and the grasshopper, for example,—and this would modify the above valuations.

This objection is very natural, and although it is founded only on a hypothesis which it would be impossible to support by figures, as it would be not less impossible to answer it by figures, we will approach it in another manner, and discuss not in general terms, but relatively to the most noxious species taken separately, the rôle which birds may play.

[*To be continued.*]

REMARKS ON A NEW FORM OF JASSID.

BY P. R. UHLER.

The North American Continent is tenanted by a group of small HOMOPTERA belonging to the family *Jassidæ*, which promise to yield very destructive species to the future agriculturist. They may be found upon the low bushes, or swept from grassy plants which grow in fields and meadows along the edges of thin woods. I add here the description of one of them to which my attention has been recently directed:

CICADULA EXITIOSA N.Sp. Long sub-fusiform, ground-color pale testaceous, polished above, but dull beneath; the upper surface of the abdomen black, excepting the lateral and hind margins of the segments. Face yellow, crossed each side by a series of slender, brown, curved lines, the outer cheeks with two brown long spots, and the forehead with a roundish, black spot each side of middle, exterior to which the reddish brown ocelli are seen next the suture, and below the latter is a small brown spot of about their size; in the middle is usually a small, brown dot. The vertex is arcuated; with the tip a little angular, the surface on the posterior half transversely depressed, and marked with a curved, brown, transverse cloud, which has two blackish dots just behind it, a small spot near each outer angle and a slender streak along the middle: any one, or several, of these are sometimes absent. Pronotum with a whitish line in the middle and a short oblique one each side, anteriorly is a strongly curved series of longish brown dots, and on the posterior half, occasionally a few obscure, cloudy marks. Scutellum with a pale line on the middle running through a brown spot, or only a faint cloud instead; each side, basally, with a whitish oblique line, and near each basal angle is a deltoid brown mark, or line. Hemelytra translucent, or faintly tinged with brown, narrow, moderately valvate, the costal nervule pale, moderately

curved; the other nervules brown, those of the clavis and its margins very much thickened, and sometimes tinged around with brownish cloudings. A few specimens show pale interruptions near the middle of the discoidal nervules. Wings milky, or almost transparent whitish. Legs pale yellow, with the knees and tarsi occasionally brownish. Sternum and base of venter black.

Length of body $3\frac{1}{2}$–$4\frac{1}{4}^{mm}$.; to tip of wings $4\frac{1}{4}$–$5\frac{1}{4}^{mm}$.; width of pronotum $1\frac{1}{2}$–$1\frac{3}{4}^{mm}$.

The genus *Cicadula* is founded upon European species which differ from the American ones in minor details of structure. As far as observation has yet extended these characteristics will not avail to constitute new subgenera. Most likely the boundaries of the genus will have to be widened to admit the other forms which are so closely related as to appear to constitute with this a very rational group.

In my collection are specimens obtained by myself in Maryland on both shores of Chesapeake Bay. At Woodbury, Sept. 4; Curtis' Creek, August 14th; Kent county, August 24th. At Denver, Col., I swept it from grasses on the plains, August 18. Friends have sent specimens to me from Texas, Florida, and North Carolina. From the Department of Agriculture, I have recently received specimens from South Carolina, taken January 29th; and from North Carolina, Mr. Lintner sends me specimens from wheat fields.

Habits of Psephenus Lecontei Lec.—This beetle has a very wide distribution, and is not uncommon in many portions of the eastern and western States. The males and unimpregnated females are very active, and in the heat of the day collect upon stones in mid-stream, which barely break the surface of the water, and are occasionally washed by a ripple. Over these stones they run in ceaseless activity, chasing each other like flies at play, and making occasional short flights over the surface of the water, but never plunging beneath it, nor suffering themselves to be submerged even for an instant. They are at such times exceedingly wary, and unless approached very cautiously, they vanish before the observer can get near enough to use his net. They leave the stone with a flight so swift that it cannot be followed with the eye, but they will invariably be found all together, and at play upon another stone at no great distance. The gravid females are found in July or August engaged in laying their eggs on the underside of submerged stones in shallow brooks. When so engaged they are very sluggish, and never attempt to escape. The eggs are of a bright orange color, and are deposited in irregular clusters. The scale-like larva is found under stones in running water. When about to pupate it crawls out of the water upon a partially submerged log or stick of drift-wood, and selects a crack, near enough to the water to remain perpetually moist. The pupa then forms under the skin of the larva, which like the scale of a Coccid protects the insect beneath.—H. G. H., Detroit, Mich.

Prof. J. H. Comstock has been in Florida, making a special examination of insects affecting orange trees, and will go to other orange-growing States, visiting California, if possible, at some time during his investigations.

A local form of our common Milkweed Butterfly (*Danais archippus*) with the ground-color pale testaceous instead of deep fulvous, is found on the island of Antigua.

Reports of the U. S. Entomological Commission.—Continued demands being yet made for the first report of the Commission on the Rocky Mountain Locust (*Caloptenus spretus*), we would state that the 5,000 copies ordered by Congress have long since been exhausted. There is a possible chance of yet getting copies through senators or representatives in Congress, or through the Interior Department. A resolution to print 30,000 extra copies has passed the Senate, but has not been acted upon by the House Committee. The second report is ready for publication, but has not yet been ordered printed. The wheels of Congress in this direction grind slowly.

Butterflies at Sea.—The following extract is from the Chronicle of Bernaldez in the Collection of the Massachusetts Historical Society (Vol. VIII, 3d Series), and refers to the neighborhood of the island of Jamaica, and probably to the first voyage of Columbus:

"A day or two after the occurrence of what has been related concerning the cacique, they saw, before sunrise, more than a million of cormorants come flying over the sea, at a distance from the land, all in one body; so that they were astonished at the sight of so great a multitude of these birds. The next day they saw from the ships so many butterflies, that they darkened the sky; and they remained till night, when a heavy rain which fell, accompanied with thunder, destroyed them."

Sexual Coloration in Butterflies.—Charles Darwin communicates to a recent number of *Nature* some interesting facts about the color of some butterflies. It seems that in the male of *Diadema bolina* and others, the colors appear brilliant and beautiful when looked at from the front, but somber and unattractive when looked at from behind. He draws the natural inference that the brilliancy is intended to attract the female as the male approaches. "We are thus reminded," he says, "of the elaborate and diversified manner in which the males of many birds, for instance the peacock, argus pheasant, etc., display their wonderful plumage to the greatest advantage before their unadorned friends."

We publish in the present number an account of the appearance and habits of the notorious Cotton Moth or Aletia. Its natural size has already been given at fig. 3 of our first number. We desire to draw especial attention of our Southern subscribers to this moth, with a view of their observing its habits during the months of March and April. There is a period of a few weeks from the time when the females issue from winter-quarters before any of the worms are observed upon cotton. It follows as a necessary consequence that the moths either feed for a few weeks before ovipositing, or else that they lay their eggs at once and that the worms can feed upon some other plant at that season growing in the South. The first supposition is the more plausible and probably correct, but we should be very glad to receive any observations on the subject, as well as to receive specimens of the moths captured, any time before the first of May.

Satyrus Pegala.—Mr. Wm. H. Edwards of Coalburgh, W.Va., desires to know whether this butterfly has ever been captured, or seen to fly in Maryland, the District of Columbia, or Virginia. A single estray has been taken at Jersey City, N. J., and the probability is that it was blown there. We shall be glad to get the experience of our subscribers in the regions indicated.

Phosphorescence of Earth-worms.—Is it generally known that the Earth-worm (*Lumbricus terrestris*) is sometimes highly phosphorescent? * * * I disturbed one the other night; it became very luminous and left a trail of light behind it as it passed along the ground.—F. W. E. Shrivell in *Science Gossip*.

Mistaken Instinct.—In July last, one fine afternoon, as we were watching my bees carrying in pollen, one of them, separating from the others, alighted on some pretty blue artificial flowers in the bonnet of a lady visitor; tried each flower carefully for honey, and, of course, finding none, flew away, no doubt much disgusted. The bee must have been attracted by form and color; the flowers were not at all natural, but had gaudy red anthers and blue stamens.—F. W. E. Shrivell in *Science Gossip*.

Typhlodromus pyri.—We noticed in our last number some observations by Prof T. J. Burrill on the Pea-leaf blister produced by a minute, four-legged mite (*Typhlodromus pyri*). We find that this mite has been figured by Prof. Glover and noticed by Prof. Taylor, the present Microscopist of the Department of Agriculture, on page 113 of the Agricultural Report for 1872.

Food habits of Ground-beetles.—Prof. S. A. Forbes of Normal, Ill., who is devoting his time with such good results to investigating the food-habits of birds, is desirous of obtaining alcoholic specimens of any Ground-beetles (*Carabidæ*) found in situations suggesting herbivorous habits. We bespeak attention to his request from our collectors of Coleoptera. The specimens may be either sent to us or to him direct. Prof. F. finds that it is not at all difficult to recognize the tissues of plants in the intestines of herbivorous insects. Spiral vessels, hairs and epidermal cells resist digestion for a long time, and the cell walls of the parenchyma can be demonstrated by the test for cellulose. There is no doubt but that the literature of economic entomology is full of blunders due to mistaken ideas respecting the purposes for which insects visit plants. So far as the Ground-beetles are concerned there ought to be neither mistake nor uncertainty as to their food-habits, because the usefulness of some of our common birds, now protected by law, is bound up with the usefulness of these beetles.

Moths and Butterflies caught by the tongue.—In that excellent monthly, the *American Naturalist*, an account was recently given of the trapping of various moths by the flowers of *Physianthus albens*, an Asclepiadaceous plant, native to Buenos Ayres, but long cultivated by our florists for its pretty white flowers and graceful, climbing habit. There is nothing new in the account of the moth-trapping peculiarities of this plant, which peculiarities we have recorded in the Transactions of the Academy of Science of St. Louis (Vol. III, p. cxv). Quite a number of different species of *Noctuidæ* and more particularly *Agrotis inermis* and *subgothica* and *Mamestra incincta* are thus caught, and we have succeeded in tracing the larval history of the last named species from eggs obtained from moths that had been so entrapped. The flutterings and struggles of these small owlet moths to escape, do not strike one as half so remarkable as those of the much larger Hawk-moths which, notwithstanding their power of wing and muscularity, in addition to their very long tongue, attempt in vain to extricate themselves when once the tip of the tongue is secured; for the harder they pull the firmer is the grasp. If they escape it is almost always at the expense of a broken proboscis. We have seen as many as ten specimens of the White-lined Morning Sphinx (*Deilephila lineata*) either struggling or hanging dead from the flowers of a single plant, and a correspondent of *Science Gossip*, from Dartmouth, England, states in the November, 1878, number of that paper, that he constantly found large Hawk-moths caught by the proboscis in the flowers, the moths dying in about ten minutes. *Nerium oleander* is reported to entrap Hawk-moths in Europe in a somewhat similar way, and *œnothera grandiflora* to likewise catch them by holding the tongue when wound around the style below the stigma. Mr. William Saunders of London, Ont., has found that *Bidens chrysanthemoides* entraps Flower-flies (genus *Syrphus*).

The Postmaster-General has rescinded previous ruling of the Department which excluded queen bees from the mails, and they will now be carried, providing they are secured in such manner that no harm can come to persons handling the mails. About a year ago entomologists experienced much annoyance by the ruling of the New York postmaster that specimens mounted on pins were non-mailable, but of late we have heard no complaint of packages of mounted specimens being rejected or condemned, and it is to be hoped that a more reasonable spirit prevails.

Prof. Cyrus Thomas has expressed the opinion that if we have a dry early summer the Chinch Bug will be very troublesome in the West the present year.

Errata.—Page 30, col. 2, l. 15, for "*Beriplaneta*" read "*Periplaneta.* Page 49, first line after "On our Table," for "Litophane" read "Lithophane." Page 52, col. 1, note, for "δκιτυον" read "δικτυον."

On Our Table.

Insect Lives, or Born in Prison, by Julia P. Ballard, is a pleasing little volume of ninety-seven pages (square 12mo.) wherein it is the writer's aim to interest children in entomology, and more particularly in butterflies and moths. The transformations and development of the various insects treated of are described very prettily, and in a manner that teaches while seeming only to interest; and the instructions for capturing, rearing, and preserving specimens are, as far as they go, clear, simple and reliable. The observations and experiences recorded are the writer's own, and the book is well calculated to inspire, in little readers, a taste for natural history. It is daintily bound, printed on toned paper, and has fifty illustrations. The publishers are Robert Clarke & Co., Cincinnati; and the price is $1.00.

Zoology for Students and General Readers, by A. S. Packard, Jr., M. D., Ph. D. New York, Henry Holt & Co.—The immense impetus which the general adoption of evolution theories has given to every branch of biological research, and the consequent rapid advance of zoological science, calls for a new text-book every few years. The present volume, from the hands of Dr. Packard, will not only be found to answer every requirement as a full compendium, giving in a clear and comprehensive manner the results of recent investigations by the most advanced zoologists everywhere, but it will be especially acceptable to American students, since it includes the work of so many of our own investigators, and is profusely illustrated with figures, many of them original, and others from bulletins and reports not easily accessible to the general student, or from treatises by many authorities. The reader will not fail to note with pleasure the almost complete absence of those well-worn figures, that have done duty in so many of the older works, from Buffon to the pages of the last edition of Webster's unabridged. Full indices, glossary, and bibliography, leave nothing to be desired in a work intended for use as a manual in the laboratory. Special features to be commended are the concise notes, giving directions for dissection and preparation of material, which follow at the end of each class, and the brief closing chapters on Geographical distribution of Animals, the Origin of species, Protective resemblance, and Instinct and Reason. As a high-school and college text-book this Zoology will fill a place that has long been vacant. The treatment is less technical than in Nicholson's "Advanced Text-book of Zoology," and it will probably be found more useful for work in the laboratory.

The Cotton Worm in the United States; being a summary of its natural history, with an account of its enemies and the best means of controlling it. Bulletin No. 3 of the U. S. Entomological Commission, by Chas. V. Riley, Washington, D. C. Govt. Printing-office. 8vo. 150 pp., 1 colored plate and 84 cuts. Our readers have had some advance matter from this bulletin laid before them. It is a summary of work done and a prodromus of the final report. To quote from the Introduction: "The facts given in this bulletin are, many of them, for the first time published. If they oppose previously accepted views and opinions, they at the same time dispel many errors that have heretofore prevailed as to some of the more important questions in the natural history of the species. The pamphlet is prepared for the benefit of the planter and popular reader, with as little of the technicality of science as is consistent with clearness and precision, and with such matter as more particularly interests the scientific reader printed in smaller type. The principal aim of the Commission has been to discover some safer and cheaper remedy than any previously in use. Its efforts in this direction have been limited by the means at command; yet, as the context will show, they have resulted in materially cheapening the cost of protecting the crop, and there is promise of still greater improvement." It can be obtained by applying to the Secretary of the Interior.

Catalogue of the Collection of Diurnal Lepidoptera formed by the late William Chapman Hewitson of Oatlands, Walton-on-Thames, England; and bequeathed by him to the British Museum. By W. F. Kirby. 4to. pp. 246. Printed for private circulation. London, 1879.

The American Bembecidæ: Tribe Stizini. By W. H. Patton. 8vo. pp. 7. (Ext. from Bull. U. S. Geol. and Geog. Surv. Vol. V, No. 3.) Washington, Nov. 30, 1879. From the Author.

Generic Arrangement of the Bees Allied to Melissodes and Anthophora. By W. H. Patton. 8vo. pp. 9. (Ext. from Bull. U. S. Geol. and Geog. Surv. Vol. V, No. 3.) Washington, Nov. 30, 1879. From the Author.

On the Fertilization of Yucca. By Thomas Meehan. 8vo. pp. 4. (Reprinted from the "N. A. Entomologist.") From the Author.

The Law Governing Sex. By Thomas Meehan. 8vo. pp. 3. (Ext. Proc. Ac. Nat. Sc. Phila., June 4, 1878.) From the Author.

Growth as a Function of Cells, and Preliminary Notice of Certain Laws of Histological Differentiation. By Charles Sedgwick Minot. Sqr. 12mo. pp. 20. (Ext. from Proc. Boston Soc. Nat. Hist. Vol. XX, March 5 and April 6, 1879.) From the Author.

Extracts from Correspondence.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

Bucculatrix Cocoons.—The *Bucculatrix pomifoliella* Clem. to which you refer (p. 23), occurs on our Apple trees, but the cocoons are not grouped and occur only scattered sparsely on the larger branches. I also noticed that many adults came forth late in the Fall, leaving the pupa case partly exserted while others hibernate in the pupa state. Is this species or a different species known on Chestnut trees? One is perforated by a hole made by some parasite. These two are in alcohol. They may represent another species, but they resemble those of the Apple very closely. Also I have two very similar cocoons taken from the twigs of the Jack-oak, and judge they are another species. W. S. B., Ithaca, N. Y., Jan. 28.

With the experience given by V. T. C. on p. 50 of our last issue, we think it highly probable that the cocoons on Oak and Chestnut may be identical with those on Apple, especially if the former trees were in the neighborhood of the latter. The question can safely be settled only by rearing the perfect insect, and we shall be pleased to receive specimens.

Interesting Notes from South France.—I have received from Mr. Monell some notes about *Colopha*, etc., which I owe, doubtless, to your kind intervention. Löw and Thomas accuse Kessler with having given *Schizoneura compressa* as a synonym of *Tetraneura alba*, while it is the true *Colopha* of Monell. He will explain in his next note on the *Elm-lice*, in which he will describe the winged pupiferous forms of both insects which are certainly emigrants from the Elm to . . . ??? Courchet's observations and my own on the *Pemphigi* of the Fir led us to the discovery that all pupiferous forms arrive in summer, on the stems of the trees, with the sexuated *proles;* only we cannot make out, as yet, to which species of gall they respectively belong. Some of them do not even belong to the genus "*Pemphigus*" and have only 5-*jointed* antennæ; yet they are certainly but a link in the biology of some species or other. I wrote a little note "*Les Pucerons du Térébinthe*" (the Plant-lice of the Fir) to follow the "*Pucerons des Ormeaux*" (the Plant-lice of the Elm), and until I ascertain, by breeding, the correlation between the winged gall emigrants and the pupiferous pseudogyne, I am obliged to create new (transitory) names for the gall-insects of *Pemphigus cornicularius*, *utricularius*, *semilunarius*, etc. I call the supposed pupiferous forms, *corniculoides*, *utriculoides*, *semilunoides*, etc.

In the "*Comptes Rendus de l'Academie*" there is an interesting paper by Fabre on some species

of Mason-bees (*Halictus*) which have an alternate generation of agamic or parthenogenetic females in summer (without males) and a sexuated one in autumn. Perez, at Bordeaux, is also doing some good work on the alterations caused in the characters of some *Andrenidæ* by the presence of Stylops, some species being only *stylopized* forms of others. Edward Saunders is also engaged on the same subject. Westwood and Sir Sydney Saunders, having asked me for the first stages of *Blastophaga* (the fig caprificator), I was lucky enough to find the larvæ in our figs (temperature 5° F.). The great news of the day is the conversion of Prof. Dumas, at Paris, to the belief in American vines as the salvation of our Phylloxera-ridden vineyards.—J. L., Montpellier, France, Feb. 2, 1880.

Notes from Kansas.—The False Chinch-bug (*Nysius destructor* Riley) has not been troublesome since I sent you specimens, but they may always be found during the hot weather under the purslane. The year 1874 so nearly used up the Colorado potato beetles that they did little harm until last season, when they came again in full force. The Maple moths (*Anisota rubicunda*) and their larvæ continued their ravages on the hill hereabout for several years, but last season I found but two or three. In Manhattan, on some lots, the trees were entirely defoliated by them, while on others scarcely a leaf was touched. The Apple Worm is increasing in numbers. A very large proportion of the apples raised last year were wormy, but we had a very small crop. Peach-borers are as bad as ever on young trees.

Plenty of Phylloxera on the Clinton grapes, but not many on the leaves of other varieties. The little yellowish beetles [*Luperus noxius* of our MS., *vide* description in next number.—Ed.] so numerous a few years ago, on the hollyhocks and the silk of sweet corn, have almost entirely disappeared.

Although we had a very wet season in 1878 and plenty of rain in 1879, the Chinch-bugs continued troublesome, injuring spring wheat very materially, also millet, and when these are cut, going for the corn. Some fields of corn were very badly damaged by them last season.

The R. M. locusts have done no damage since the spring of 1875. They are seen flying over nearly every season and sometimes a few have stopped, but generally none, or so few as not to be noticed. The larvæ of the white-lined morning Sphinx so exceedingly numerous a few years ago, have not been unusually plenty since, though many of the moths may be seen every season.

T. C. Wells, Manhattan, Kansas.

European Tussock-moth.—Last fall the caterpillars of the European or Russet Tussock-moth (*Orgyia antiqua*) were abundant on our shade trees, especially on the willows. Now (Jan. 26, 1880) their grayish cocoons may be found in the bark-crevices of the bodies and main branches of those trees. At present they are more easily found, since the moth has appeared and deposited a large mass of eggs an inch long and covered by a hard pinkish-white frothy secretion on each cocoon. These eggs should be gathered and destroyed before spring, since this insect has been a serious pest in Europe. All the cocoons *without exception* bear eggs. Must we conclude from this that there are no males to this generation and that the wingless females are parthenogenetic? To me it seems thus. What is known of the males of this species? The common canker-worm of the apple has not been bad here though some exist, and I caught the wingless female in the early part of the winter.

W. S. B., Ithaca, N. Y.

The male of *O. antiqua* is figured and described as equally common with the female, in European works.

Cicada septemdecim in Colorado.—Apropos of remarks in No. 2 on *Cicada septemdecim*, has its occurrence in Colorado been recorded heretofore? I found it in Cheyenne Canon in June 1876.

V. T. C., Covington, Ky.

Cotton Moth or Aletia.—I send you to-day a small box containing some moths which I caught on the night of the 12th inst. between 9 and 11 o'clock. I also send a berry, leaves and bloom of the mock-orange (*Cerasus carolinensis*), the tree on which the moths were feeding. The winds were high from the south-west; the clouds were dark and threatening, with the thermometer at 70° There have since been three light frosts; but the bees and the butterflies are out again to-day.

James F. Bailey.

Marion, Ala., Feb. 16, 1880.

Two of the moths sent were females of Aletia, perfectly recognizable, though without fringes and with pale, faded coloration. This is most interesting confirmation of the hibernation, and winter habits, of the insect. The ova had attained no development and could scarcely be recognized. The other moths sent were an Agrotis too much rubbed for specific recognition, a Geometrid in similar condition, and *Phoberia atomaris*.

Answers to Correspondents.

[We hope to make this one of the most interesting and instructive departments of the Entomologist. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wood, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Common Tiger-beetle.—*J. L. Sency, Plymouth Co., Iowa.*—The insect which you found last

spring concealed in a heap of gravel belongs to the Tiger-beetles (*Cicindelidæ*) and is known to science as *Cicindela repanda* Dej. It is very common throughout the whole extent of the United States, especially in the more northern States. Like its numerous congeners your species preys on all sorts of other insects, while the larva lives in holes in the sand and is also insectivorous.

Gall on Pelargonium.—I send you with this note a tiny gall-making insect, altogether too small and spry for me to make anything out of. It seems to be a Neuropterous insect. Is it allied to the Podura? I never heard of any of these insects making galls. The gall, which I enclose, was growing at the base of a healthy Pelargonium. On cutting the gall I found many larvæ and little spring-tails which flew about in every direction.—M. T., Vineland, N. J., Jan. 24.

Nothing but the little Poduras was found in the package sent, though there seemed to be some dead, soft animal remains of unrecognizable shape in parts of the galls which have all the appearance of having been made by a mite. No Poduras are known to make galls, and the species in question was undoubtedly feeding simply on the softer and diseased gall-tissue of the plant.

Catalogues and Monographs of Insects.—Will you be so kind as to tell me whether there is any catalogue or monograph on the Hymenoptera, Lepidoptera, Orthoptera, Neuroptera, Hemiptera and Vermes of our country and whether accessible or not? We need such in our Zoological Laboratory for the students, and trust you may be able to give us information in this matter.—P. S. B., Asbury Un., Greencastle, Ind.

No complete monographs of the orders mentioned have ever been published, except the Synopsis of North American Neuroptera by Dr. H. A. Hagen, and the Synopsis of North American Lepidoptera by Dr. Jno. G. Morris in the Miscellaneous Publications of the Smithsonian Institution—both of them somewhat out of date. Numerous monographs of single families, however, have been written by various authors, but they are scattered through the volumes of our scientific periodicals or through the publications of the Government. Some of these monographs, especially the older ones, are now out of print, but many are yet for sale separately, and can be obtained through Mr. E. P. Austin, 46 East Newton St., Boston, Mass., or through the Naturalist's Agency, (S. E. Cassino,) Salem, Mass. Of complete catalogues there is one of the North American Coleoptera by G. R. Crotch, and one of the Diptera by Baron R. Osten Sacken. In the Lepidoptera, besides the catalogue by Dr. Morris, more recent ones have been published of the Diurnal Lepidoptera by Mr. H. Strecker and Mr. Wm. H. Edwards, and of the Nocturnal Lepidoptera by Mr. A. R. Grote. In Orthoptera there is one catalogue by Mr. S. H. Scudder, published by the Smithsonian Institution. Catalogues of various families of the other Orders are published and scattered through our periodical literature, and can be obtained of most dealers.

Leaf-hoppers injuring Wheat Fields.—I inclose a few imperfect specimens of an insect infesting our wheat fields in myriads. I have observed them since October. The weather here has been so mild that they have been very active until the past three or four days, even with the thermometer as low as 23° F. I fear they are the destructive Hessian fly. I have never seen a Hessian fly nor its description.

They vary in color. Some are greenish hued —but most are gray or ash colored. They are active and seem to move like grasshoppers, making a flight from two to ten feet.

Jan. 17, 1880. R. L. B., Lenoir, N. C.

The insects are not the Hessian fly but a Leafhopper new to science. You will find a description of it, by Mr. Uhler, in the present number, under the name of *Cicadula exitiosa*. The common *Jassus sexnotatus* of Europe has long been known to injure wheat fields, and there are several species of the same group that are injurious in this country, especially in the south and southwestern States. In the latter States they are not infrequently taken for young grasshoppers, injuring meadows and more particularly wheat and oat fields. Two other species besides that described by Mr. Uhler, are more particularly concerned in such work. One species, measuring 5.5^{mm} (about .22 inch) of a beautiful green color with yellow head and legs is quite common in Texas, and will be found described as *Diedrocephala flaviceps* in the descriptive department of this number; another is a species of *Jassus* allied to *Jassus inimicus* Say. It is difficult to suggest a remedy for these active, hopping creatures, as their habits in fields and meadows have not yet been sufficiently studied. We would recommend, however, the pasturing of the fields to sheep.

DESCRIPTIVE DEPARTMENT.

A NEW LEAF-HOPPER INJURIOUS TO SMALL GRAIN.

BY C. V. RILEY.

Diedrocephala flaviceps n. sp.—General color and appearance of *D. mollipes*, but about half the size and with less acute head. Hemelytra deep green with whitish-yellow veins and pale border broadening posteriorly. Head orange in front with a pale border, sometimes showing in three distinct spots; sulphur-yellow behind, the two ocelli looking like beads raised on a dark green, nearly black patch, relieved inside by white; eyes dark green; thorax dark green, but with more or less sulphur-yellow around anterior border, and with the posterior margin pale; scutellum yellowish, sometimes mottled with green. Under-surface pale yellow, immaculate. Average length 5^{mm}.

Numerous specimens injuring wheat and oats in Texas in 1876. It was marked *Tettigonia flavicephalum* in Fitch's collection, as Mr. Uhler informs me, but never described.

TWO DAYS' COLLECTING IN THE MAMMOTH CAVE, WITH CONTRIBUTIONS TO A STUDY OF ITS FAUNA.

BY H. G. HUBBARD, DETROIT, MICH.

[*Continued from p.* 40.]

FAUNA OF THE MAMMOTH CAVE.

Vertebrata: 1. Vespertilio?
2. Mus rattus? partially blind.
3. Amblyopsis spelæus De Kay.
4. Typhlichthys subterraneus Gerard.

Insecta: 5. Anophthalmus Tellkampfii Er.
6. " Menetriesii Mots.
7. " interstitialis Hub.
8. Adelops hirtus Tellk.
9. Raphidophora subterranea Scud.
10. Anthomyia sp.
11. Phora sp.
12. Campodea Cookei Pack.
13. Machilis sp.
14. Myopsocus or Elipsocus sp.
15. Atropos divinatoria Muell.

Arachnida: 16. Anthrobia monmouthia Tellk.
17. Acanthocheir armata Tellk.
18. Phrixis longipes Cope.
19. Chthonius Packardi Hagen (form with two eyes.)
20. Acarus? sp. (living on offal.)
21. Mite (living on Anophthalmus.)

Myriapoda: 22. Spirostrephon Copei Pack.
23. Unknown myriapod seen by Hyatt.

Crustacea: 24. Cambarus pellucidus Tellk.
25. Asellus (Cæcidotea) stygius Pack.

Vermes: 26. Nematode? (intestinal parasite of larva of Adelops.)
27. Leech? (in pools of water.)
28. Unknown ciliate Infusorian? (attached by stalk to Asellus.)

In addition Ehrenberg (*Microgeologie*, 1856) gives a list of eight Polygastric Infusoria (*Biddulphia? fossil? Bodo? Chilomonas*, *Gaillonella?*, *Kolpoda*, *Monas*, 2, *Synedra ulna*); one fossil *Polythalmia* (Infusorian); five *Phytolitharia;* and plant forms (Microscopic fungi). These forms present no striking peculiarites.

The following notes are intended to supplement the descriptions of cave Articulates already made known by Packard and Cope in the pages of the *American Naturalist.**

Campodea.—Specimens vary greatly in size. The largest from which the accompanying figure was drawn (Fig. 8,) measures $7.4^{mm} = .29$ in. in length, exclusive of the caudal stylets, which are one half longer than the body. It is more robust and more pubescent than any of the others, and may be the other sex, or even another species. The number of joints in the antennæ is very variable, the specimen figured has the greatest number, 37, the others have 34, 32, 31 and 30 joints, the two smallest specimens which are one half as long as the first, have 32 and 31 antennal joints. Dr. Packard's description of his new species *Campodea Cookei* (*l. c.* v. 747) will hardly suffice for the proper recognition of the species, especially if there should prove to be other species here. The stylets, which appear to have been broken off from all specimens hitherto brought from the caves, consist of eleven cylindrical joints, the first moderately long, equal to the second and third together, the second very short, the third longer, the succeeding joints increasing in length, the fifth being equal to the first, and the last equal to the first three. All the joints are slender, covered thickly with hairs, and with a close whorl of spinules at the articulations. My specimens, seven in number, were all found upon boards in the Rotunda and far from water. They have the habits of their relatives the bristle-tails (*Lepisma*). Mr. Cooke's statement that his unique specimen was found in pools in company with *Cæcidotea*, may be a mistake. Prof. Cope relates the finding of the crustacean by Mr. Cooke while in his company, and says nothing of the discovery of an aquatic Thysanuran at the same time.

Phrixis longipes Cope—(Fig. 9). In Prof. Cope's description of this species (*l. c.* vi, 421) some confusion occurs as to the tarsi. In the longest legs the number of joints was not counted, although they are mentioned as "multiarticulate," and this, with the absence of eyes is made to characterize the genus.*

In the specimens before me, the anterior and shortest pair of legs have five-jointed tarsi, ending in a single claw, without an opposing bristle, as given by Cope. The second and longest pair have nine tarsal joints, with a single claw. The third and fourth pairs are intermediate in length between the first and second, they have each six-jointed tarsi and a pair of claws. The first tarsal joint in all the legs equals or exceeds the femora and tibiæ, the second joint, though shorter than the first, is very long. The palpi (that of the left side is omitted in the figure) have five joints and a terminal spine, the basal joint bears a single spine, the second joint has five, three below the middle, springing from the outer edge, two above, springing from the inner edge; the third joint has one on the outer and two on the inner edges; the fourth joint has two external and three internal, and the fifth, two spines on either edge; the spines are all tipped with long bristles, bent towards and crossing those of the opposite row. The male organ is cylindrical, without joint or median swelling, as thick as the coxæ, not chitinous, bearing at tip a few fine hairs; when fully protruded it equals one third of the body in length. The abdomen shows but four narrow and one conical terminal segment beyond the cephalothoracic shield. The conical eminence at the anterior border of the dorsum, between the first pair of legs is without trace of ocelli. Length without appendages, $2^{mm} = .08$ in.; longest leg $18^{mm} = .72$ in.

Two specimens in alcohol, from Martha's Vineyard in the Mam. Cave.

Cæcidotea † *stygia* Pack.—(Fig. 10). The specimen from which Dr. Packard's description was

*By A. S. Packard, Jr. The Mammoth Cave and its Inhabitants, *l. c.* Vol. V, p. 739.
The Cave Beetles of Kentucky, *l. c.* Vol. X, p. 282.
By Prof. E. D. Cope. On the Wyandotte Cave and its Fauna, *l. c.* Vol. VI, 409.

* The importance of the presence or absence of eyes as generic characters in cave Articulates, appears to be overestimated by Prof. Cope, and his two new genera *Phrixis* and *Erebomaster* are very doubtfully distinct. Among Pseudo-scorpions the number and position of the eyes have hitherto been considered invariable characters for the definition of the genera. The species of *Chthonius* living above ground, have four eyes, but in the caves, the same genus, according to Dr Hagen, is represented by two forms, one blind, the other with two eyes, and which are thought by him to be specifically identical.

† Prof. S. A. Forbes of Normal, Ill., does not recognize the genus *Cæcidotea* as distinct from *Asellus*.

made appears to have been much mutilated, and his figure (*l. c.* v, 751) is very incorrect. The head is represented much too large, and the antennæ are reversed in relative position. Prof. Cope describes, from the region of the Wyandotte Cave a *Cæcidotea* distinguished from *C. stygia* by its smaller and more acuminate head (*l. c.* vi, 411 and 419). Apparently the comparison was made only with Packard's figure, if so his species (*C. microcephala*) is very doubtfully distinct. The external egg-pouches with which its body is made to terminate, are certainly fanciful creations having no existence in this Isopod crustacean. It is difficult to understand how their number and position could be determined in specimens which "are in bad condition, having lost their limbs, egg-pouches, and the distal portions of their antennæ." Packard's specimens had also lost the longer antennæ, and neither of these authors mention the existence of caudal stylets.

The following additions and corrections will aid in the determination of the Mammoth Cave species:

Inner, short antennæ with from nine to twelve joints, the first three subequal, much longer and stouter than the rest, together making nearly half the entire length of the organ; fourth joint very short, oblique; fifth joint longer; the remainder diminishing in length and thickness to the end. The four outer joints bear on the inside a flattened, cultriform spine, terminal joint minute, tipped with a bristle, bearing the cultriform spine upon a projection at the side. Outer antennæ nearly equal to the body in length, with three large basal joints, the first short and stout; the second long, together with the first about equal to the inner antennæ; the third equal to the two first, and also to the thirteen following; the remaining joints closely applied, transverse at first, gradually diminishing towards the tip of antennæ. In six specimens the number of short joints of the outer antennæ was found to be, by careful count, respectively 60, 57, 50, 40, 40 and 36. The number of short joints varies also in the inner antennæ, and is not always the same in both members of the same pair. The caudal stylets are long, flattened, two-branched; the longer branch terminal, bent downwards; the shorter, spindle-shaped, directed outwards from near the apex; both are tipped with a few bristles. The stylets vary from 3.5^{mm} to 2.75^{mm} in length. Measurements of a large number of specimens show great variation in size, the length of the body proper ranging from 4 to 9^{mm} and the appendages varying in specimens of the same size. The specimen here figured is of medium size, and gives the following measurements,—length of body 7^{mm}=.28 in., long antennæ 6.25^{mm}=.25 in., stylets 3.5^{mm}=.14 in.

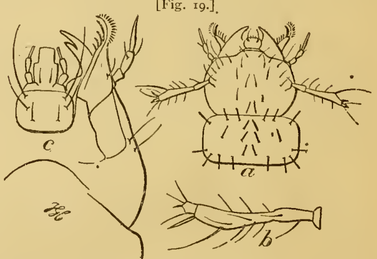
Clustering about the head and base of antennæ in some specimens are seen numbers of minute pear-shaped organisms, covered with hairs, and attached to the surface of the crustacean by thread-like pedicels; a short tube, or cylindrical projection is sometimes visible near the apex, and the contents appear to be granular with usually a large nucleus or vacuole, occupying the lower portion. They were not examined with high magnifying powers, but may perhaps be stalked, ciliate infusoria. Two of these bodies are represented attached to the antenna at FIG. 10, *b*.

Adelops hirtus Tellk.—(Fig. 19, *a* head of larva from above, *b*, right antenna from above, *c*, labium, left maxilla, etc., from below, all much enlarged). The immature forms of *Adelops* have never been properly noticed. Packard's figure of the larva (*l. c.* vol. x, pl. ii.) represents a much contracted specimen, the body tapers too rapidly, and the thoracic segments are nearly one-third too wide, antenna (FIG. 4, *a*, of his plate) is incorrectly drawn.

The following description made from numerous well preserved specimens, is an attempt to give this larva the careful attention its importance deserves:

The body is stout and cylindrical, gradually tapering from the thorax, slightly compressed above, dorsal shields covering the segments, very thin and transparent. Color dull white, with the head darker, and tips of mandibles alone testaceous. Length 4.4^{mm}=.17 in. Head free, nearly as wide as prothorax, rounded, convex,

[Fig. 19.]



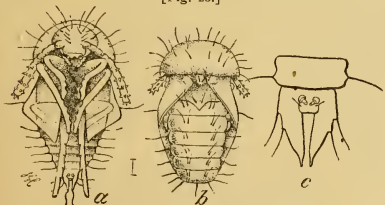
ADELOPS HIRTUS: *a*, head of larva from above; *b*, antenna; *c*, underside of head (after Hubbard).

broader than long, sides slightly rounded, truncate in front, sparsely covered with fine hairs. No ocelli. Antennæ arising from the convex sides of the head, just before the middle, directed backwards; of four joints, the first tuberculous, the second elongate-cylindrical, slightly enlarged anteriorly, the third twice as long as the second, slightly curved, thickened on the inner (anterior) side, sparsely covered with bristles, a longer bristle on the inside at the thickest portion, a stout spine on the inside at apex, fourth joint appendiculate, bearing lateral bristles and a short spine at tip. Epistoma prominent trapezoidal, strongly angulate, edges straight. Labrum movable, deflexed, transverse, oval, bearing spines above and below. Mandibles stout, lobed at base, with molar surface striate, moderately curved, bidentate at tips, overlapping when closed. Maxillæ large, prominent, passing the mandibles, protuberant and strongly angulate at base, consisting of elongate cardinal and basal pieces, and a pyramidal palpiger, obscurely separated into two lobes by a longitudinal furrow, the upper lobe bearing internally four or five spines, the lower lobe terminating in a curevd, ciliated crest; maxillary palpus, arising from the base of the palpiger, of two stout basal and one

slender, spiniform, terminal joints. Labium with a large rounded mentum, broader than long, slightly narrowed behind, bearing long hairs, labial palpi widely separated by the base of the ligula, of two joints and a palpigerous piece resembling a third joint Ligula very large, prominent, elongate, with a square lobe in front, nearly reaching the tips of the palpi. Thoracic segments equal, larger than the abdominal segments, twice as wide as long, side margins produced, dorsal surfaces with two, and on the prothorax with several, rows of short blunt spines; sides of prothorax less strongly rounded than the following segments; each with a pair of moderately long legs, of two joints and a terminal claw-joint representing the tarsus, tibia clothed with spinules. Abdomen of nine strongly transverse segments, each with a row of six blunt spines above, which are replaced by sharp spinules on the ventral surface, terminal segments bearing a pair of moderately long appendages with one short cylindrical basal joint, the remainder setiform, very obscurely multi-articulate. Anal prolongation stout, tubular, ending in four fleshy lobes which are usually retracted into the rectum. Stigmata nine pairs, the first pair larger, situated in the fold at the hind angles of prothorax, the eight remaining pairs on the first eight abdominal segments, at the middle of the edge of the dorsal shield, and immediately below a short tubular spine (the last spine of the dorsal row).

The larva of *Adelops* presents the general characters of Silphid larvæ as given by Erichson, but is most closely allied to those of Liodes and Agathidium. From the larger Silphidæ it differs

[Fig. 20.]



ADELOPS HIRTUS: *a*, pupa, underside; *b*, do. from above; *c*, anal appendages (after Hubbard).

notably in possessing a movable labrum, not soldered to the clypeus, and from all described larvæ of the family in having the palpigerous pieces of the lower lip (labium) widely separated, forming in fact a third joint of the palpi, and in the size and prominence of the ligula. There are no long sensitive hairs upon any part. Of the larva of *Catops* its nearest ally, no description is known to me, except that of *C. fuscus* Gyll. by Erichson, which is too short to be of use.

The pupa, (Fig. 20, *a*, ventral, *b*, dorsal view, enlarged 10 times, *c*, anal appendages, much enlarged) now first made known, is characterized as follows:

It is short, thick, almost conical, broadly rounded anteriorly, suddenly tapering behind, sparsely covered with fine hairs. Head bent downwards upon the breast, not visible from above, upper lip prominent, emarginate, tips of palpi projecting, free, constricted at the joints. Antennæ bent upwards and backwards, lying back of the knees in the concavity of the prothorax, and projecting beyond the dorsal surface at its hind angles, constricted at the jóints, the outer half a heavy club, each articulation of which bears large spiny tubercles. Prothorax very large, almost hemispherical, covering the body like a hood. Wings folded over on to the ventral surface, lying under the anterior legs, covering the thighs of the last pair. Dorsal surface almost entirely exposed, at the base of the wings three conical protuberances placed close together, the largest

[Fig. 21.]

Cells of Adelops.

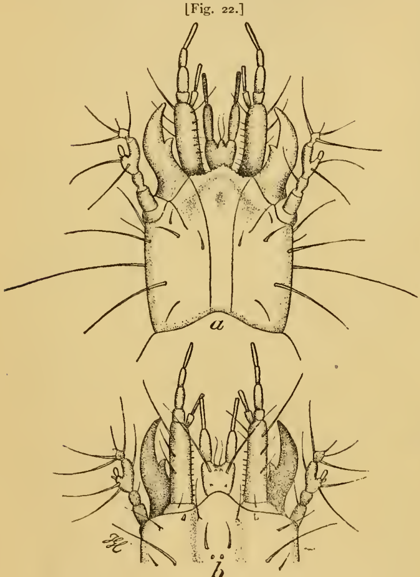
on the median line covering the scutellum, the two smaller on either side upon the elytra; the tip of the metathorax protuberant, acutely prolonged over the first abdominal segment. Abdomen strongly arched downwards terminating in two thigh-shaped appendages with two or three long hairs on the sides, and a curved bristle at their apices, between them at the base, a lobe surmounted by two converging tubular processes. Color transparent white. Length 2.5^{mm}=.10 in., width 1.5^{mm}=.06 in.

Anophthalmus sp.—Larva (Fig. 22, *a*, head, much enlarged. *b*, underside of same.) No detailed description of this larva has yet been published. Packard's figure (*l. c.* x, pl. ii) sufficiently well represents the form.

General form long and very slender, cylindrical, gradually narrower in front, more suddenly behind. Color brilliant white, head and legs honey-yellow, with the mandibles darker, dorsal shields of the thorax tinged with yellow, those of the abdomen colorless. Length of a somewhat distended specimen 8^{mm}=.32 in. Head rather small, inclined upwards, nearly quadrate, slightly narrowed behind, flattened above and below, sides almost straight, posterior border sinuate above, broadly emarginate below, with a few hairs, longer on the sides. Head above with anterior border projecting between the mandibles in an obtusely tridentate clypeus, with thickened, slightly reflexed margins, a shallow, arcuate impression extending between the bases of the antennæ, and following the frontal margin, an oval depression at the summit of the frontal elevation midway between the antennæ, Y-suture represented only by the upper portions of its branches, which extend from the base of the clypeal projection on each side, backwards and inwards, half way to the median line. Head beneath with anterior border slightly rounded, lobed by the projection of the mentum. Eyes wanting. Antennæ placed above, in slight emarginations at the anterior angles of the head, projecting forwards, not longer than the mandibles; of four joints; the first uniformly cylindrical; the second shorter, enlarged anteriorly, with a single bristle; the third longer

than the first, deformed, the basal half a thickened palm, bearing a small, oval, porrect lobe, and minute papillæ, the remainder of the joint a curved, cylindrical continuation joining the palm on the inside, two bristles on the palm and one on the finger; fourth joint appendiculate, bearing several long lateral, and one minute terminal bristles. Mandibles moderately long and thick, arcuate, with a short tooth near the middle. Maxillæ consisting of a very short cardinal piece, a stout cylindrical basal piece, longer than the mandibles, with two long, and several short external bristles, above with a row of six or seven spinules near the inner margin, and two internal bristles near the apex, surmounted by a two-jointed internal lobe, the basal joint thicker and shorter than the terminal, and a four-jointed palpus; the first and second joints thick, the first very short; the second much longer; third and

[Fig. 22.]



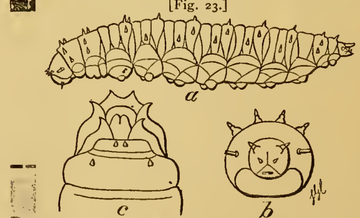
Anophthalmus sp. *a*, head, much enlarged; *b*, underside of same (after Hubbard).

fourth joints together equal to the first two combined, more slender, terminal joint longest. Mentum elongate, convex, separated from the under surface of the head only by shallow longitudinal, parallel impressions, projecting slightly beyond the anterior border as a rounded lobe, surmounted by a convex palpiger, not broader than long, somewhat obcordate, the anterior emargination deeper when seen from above. Labial palpi of two joints, equal in length, the first thick the last slender. Ligula invisible from below, distinguishable from above as a minute papilla placed at the bottom of the emargination between the palpi, and bearing two hairs. Thoracic segments narrower than the abdominal segments, moderately convex above, flattened beneath; the prothorax oval, longer than broad, sides gently curved, anterior border sinuate, produced at middle; meso- and metathorax broader than long, more strongly rounded on the sides, widest behind the middle; dorsal shields elliptical, fringed with short brown hairs, prothoracic shield larger than the following. Legs moderately long, subequal and similar, sparsely clothed with hairs, of five joints and a claw; coxæ widely separate, conical, stouter and longer than the other joints; trochanter, femur, and tibia exactly equal; tarsal joint rather longer, more slender, tapering; tarsal claw shorter, curved, pointed. Abdominal segments nine in number, convex above and below, strongly rounded on the sides; dorsal shields transverse, elliptical, indicated by fringing, short, brown hairs; on the side of each segment a prominence bearing a few hairs; segments 1 to 4 insensibly increasing in size; then decreasing to the 7th, which equals the 1st; 8th sensibly smaller; 9th much smaller, conical, ending in a pair of rather stout appendages, not exceeding the segment in length, curving inwards, bearing bristles, and a cylindrical anal proleg, when distended showing two diverging lobes, equal to the appendages in length. Stigmata normal, one larger pair on the prothorax, placed posteriorly a little below the middle of the side, the following on segments 1 to 8 of the abdomen, above and a little in advance of the lateral hair-bearing prominence, exceedingly minute, and from their want of color barely visible. The hairs of the body are few in number and very short, those of the head are no longer than are seen on most carabid larvæ, and bear no comparison to the long sensitive hairs found upon all parts of the imago.

A single specimen in alcohol, found on wet sand near Hebe's Spring, Mammoth Cave, six miles from the entrance. The species may be either *A. Tellkampfii* or *A. Menetriesii*. Except in its very elongate form I can find no striking differences between this and other Carabid larvæ allied to *Trechus*.

Phora sp.—(Fig. 23 *a*, larva enlarged 10 times, profile; *b*, front view of head and thorax; *c*, anal propleg from above; *a* and *b* much enlarged.) The larva of the smaller cave fly is cylindrical,

[Fig. 23.]



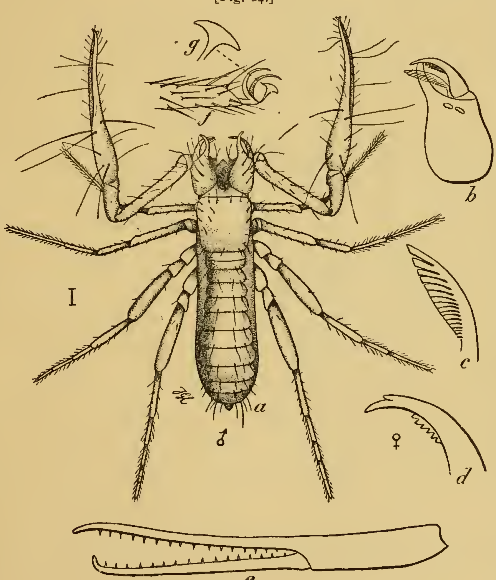
Larva of Phora: *a*, side view; *b*, head and thorax from front; *c*, anal joints from above (after Hubbard).

narrowed in front, more suddenly narrowed behind. Head small, rounded, convex, deeply inserted in the thorax; above on each side an acute, three-jointed tubercle; in front a second pair of very minute tubercles, separated by a sutural line, which branches below them; space between the branches of the Y-suture excised, enclosing the buccal opening, which appears as a dark transverse slit. Three thoracic segments smaller than the abdominal segments, retractile, bearing at or near the anterior border a row of acute tubercles or spines; the prothoracic with a pair of tubular spines arising from depressions at the middle of each side. Abdomen of nine segments, each with three folds on the dorsal

surface, the posterior fold bearing a row of spines similar to those on the thorax; sides wrinkled, with tubercular prominences between the segments, and one or two spines anterior to those of the dorsal row; ventral surface, each segment with three transverse ridges, one median, slightly in advance of the two lateral ridges; two last segments smaller, the terminal with an anal projection consisting of two large retractile tubercles, directed upwards and bearing spiracles, surrounded by six radiating spiny processes. Color dull white, darker at the extremities. Length when moderately distended $5^{mm} = .21$ in. Several specimens in alcohol.

The larva of the European *Phora Dauci*, observed by Bouché in rotten radishes, is figured without detail by Westwood, (Int. to Class'n ii, Fig. 132, 12) that of *P. incrassata*, found in bee-hives, is reproduced in Packard's *Guide*. Both agree with this larva, as far as the figures and descriptions go.

[Fig. 24.]



CHTHONIUS PACKARDI: *a*, ♂ enlarged fifteen times; *b*, mandible; *c*, bristle of the mandible; *d*, finger of the mandible; *e*, chela of palpus; *f*, end of tarsus; *g*, plantula (after Hubbard).

The pupa is visible through the skin of the larva, which becomes an indurated puparium, light red in color, oval, pointed at the ends, smooth and convex beneath, more depressed on the dorsal surface, which is margined, with the segments indicated by ridges. The extremities of the puparium show the parts of the larva unchanged. Length $3.6^{mm} = .14$ in.

All the stages were found on offal in Washington Hall, Mam. Cave, Aug. 21st. Imagos appeared from pupæ taken to Detroit, Michigan, a week later.

Dr. Hagen has, with the greatest liberality, placed at my disposal his unpublished descriptions and figures of new Pseudo-scorpions belonging to the genus *Chthonius*. The following is the description of the cave species. The few changes I have taken the liberty of making in his manuscript, have been rendered necessary by new facts developed in correspondence, and in an article published in advance of the descriptions by Dr. Hagen in the *Zoologischer Anzeiger*, Leipzig, July 1879.

Chthonius Packardi Hagen, n. sp.—(Fig. 24, *a* ♂, enlarged fifteen times, *b* left mandible from below, *c* feathered bristle of the mandibles more enlarged, *d* movable finger of mandible, occasional in ♀, *e* chela of the palpus, *f* termination of tarsus, *g* plantula from above.) "Dull whitish, mandibles and palpi very light brown, segments of the abdomen yellowish white. Thorax flat, a little longer than broad, quadrangular; very little enlarged just before the anterior border and a little narrowed behind in female; lateral borders nearly straight, a little convex just before the anterior border, where the eyes should have been; angles rectangular, the hind ones scarcely rounded; no eyes; thorax smooth with a few sensitive bristles, four on each side, two near the anterior border and two near the posterior one; two more in the middle each side nearer to the anterior border, which is a little produced in middle; mandibles large, one third shorter than the thorax; base convex above, oblong, a little narrowed to the fingers, which are shorter than the base; the movable finger incurved, strongly pointed, with sometimes a small knob or external indentation before the tip; on the underside of the base, just before the division into fingers, internally three long feathered bristles placed in a line, usually larger on the left mandible, sometimes wanting (or rubbed off?); abdomen less than twice as long as the thorax, scarcely broader at base, ovoid, thicker in the female; two rows of hairs on the segments 1 to 3, four rows on the three following segments, and six rows on the two following segments;* a transversal row of hairs on each ventral segment. Male with the second ventral segment triangularly excised; female with two small holes; palpi thin, longer than the body by about the length of their fingers; hypopodium oblong, incurved; trochanter short, enlarged at tip, incurved, about half as thick as long; femur very long, straight, cylindrical, slender, a little convex above before the tip, as long as the thorax and the three basal segments of the abdomen; tibia similar to trochanter, incurved, enlarged at tip, less than half as long as the femur; chela thin, one half longer than the femur; the hand as thick as the tibia, cylindrical, a little enlarged below just beyond

*The number of hairs is found to vary on the abdomen, Hub.

the articulation, straight, shorter than the femur; fingers as long as the femur; slender, straight, viewed in profile a little incurved, the tips hooked suddenly, the movable finger a little shorter; both with a series of sharp teeth inside; legs slender, the two anterior pairs as long as the body, the two posterior pairs extending beyond the body the length of the tarsus; hypopodia oblong, a little incurved, those of the first pair a little pointed before; trochanter short, a little longer than thick; femur long cylindrical, tibia half as long as the femur; first tarsal joint as long as the tibia, second as long as the femur; the two posterior pairs with the trochanter and base of the femur enlarged; femur with a spurious articulation before the middle; first tarsal joint shorter than the tibia; all legs with long fine hairs; two very slender and strongly curved hooklets on tip; between them an anchor-shaped plantula with a thin cylindrical stem. The palpi of female are as long as those of the male. Length 2.3^{mm} = .09 inch. Hab. Wyandotte Cave. Indiana; five males, one female in alcohol. The female has a small external indentation of the movable finger of the mandibles; the finger of the males has no indentation, but in two specimens the tip is somewhat broader, more obliquely cut, and with a fine engraved line where the indentation should be."

The discovery of this blind Pseudo-scorpion in America is very interesting. It belongs without any doubt to Schiœdte's genus *Blothrus*, which on careful examination proves however to be merely *Chthonius* with undeveloped eyes, and is the smallest species known.

"*C.* (*Blothrus*) *spelœus* differs by the longer tibia of the palpi, and by the two anterior pairs of legs with a two-jointed tibia. The last statement is doubted by Mr. Simon, but Mr. Schiœdte's accuracy is so well known, that his statements are to be accepted. (*B.*) *Abeillii* has much longer palpi and legs, and the sexes of dissimilar development. (*B.*) *brevimanus* is only known to me by an insufficient diagnosis. (*B.*) *cephalotes* seems rather similar to (*B.*) *Packardi*, only a little larger, the mandible granulated, nearly as long as the thorax; the fingers of the palpi equally longer."

Another form, with two eyes, occurs in the Mammoth Cave;

It is "pale yellowish; the thorax, mandibles, palpi, legs and segments of the abdomen about the same color; the base of the mandibles a little darker, the abdomen between the segments and on the sides paler.

I have seen only three specimens in alcohol, all from the Mammoth Cave region, one couple from one locality and a female from another locality. I have compared all very carefully with *C.* (*Blothrus*) *Packardi* from Indiana. They are a little longer, 3 to 3.2 millim long, a little darker, or perhaps a little less white, but all three have on each side of the thorax one eye, distant from the anterior border as far as the length of the diameter of the eye; the movable finger of the mandibles is not indented. The examination of all other details shows no difference. Hab. From the bottom of Dome, Mam. Cave, with dead bat, Nov. 9th, and Long Cave near Glasgow Junction, Ky., one mile from daylight, May 11th."

My specimens, two males and two females from the Rotunda in Mammoth Cave, have each two eyes, which however vary in the convexity of the cornea and are so faint as to be easily overlooked. The males are very white, one of the females shows traces of an indentation on the mandibular finger. The male from which the figure was drawn measures 3 millim. in length, or exclusive of the mandibles 2.3^{mm}. The hairs upon thorax and abdomen, which are correctly represented in the figure, differ slightly from the description of the blind form, but they are probably variable.

In his article in *Zoologischer Anzeiger*, July 1879, Dr. Hagen refers to this form as follows:

" * * As the position and number of the eyes has hitherto furnished for *Chelifer*-genera a trustworthy indication, I had described it as a new species.* A subsequent very close comparison with (*Blothrus*) *Packardi* gave as a result that the two species appear to be identical, only, the former has two eyes, the latter is blind. Further research showed that neither can be separated from the genus *Chthonius*, which has two eyes on each side. Consequently we have here the interesting fact, that *Chthonius* living without the caves has two eyes on either side, and that within the caves live forms of this genus, in which either only the anterior pair of eyes is aborted, or these too are wanting, and light-refracting cells (lichtbrechende Kerne) under the skin at the base of the sensitive hairs seem to form a partial substitute for the wanting organs of sight."

To Dr. H. Hagen my grateful acknowledgments are due for invaluable aid and suggestions. I have added nothing to his observations on Pseudo-scorpions, the portions indicated by quotation marks are copied almost verbatim from his manuscript.

Atropos divinatoria Muell.—This is one of our commonest insects and found everywhere. Its occurrence in the Cave, though probable, is not certain, as it was found upon offal from the Cave after it had been taken to Detroit. The two specimens of Psocus found in the Rotunda have been examined by Dr. Hagen who pronounces them fully developed imagos, but of the short-winged kind. They have developed eyes and three ocelli and are therefore not nymphæ. Dr. Hagen sends the following notes:

"The short-winged imagos differ from the nymphæ by the short wings fastened only to the exterior corner of the thorax, and the wings are even shorter than the wing-covers of the pupæ would be. Both belong to the Psoci with three-jointed tarsi, therefore to *Myopsocus* (one Amer. species known) or to *Elipsocus* (three Amer. species known). But as the N. Amer. species of Psocus are very imperfectly studied, this species may belong to one still undescribed.

At all events it is particularly interesting that in the caves such imagos imperfectly developed occur."

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* Under the manuscript name *C.* (*Blothrus*) *incertus*.

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THE CHINCH-BUG.*

ITS WINTER HABITS.

It was known soon after the insect became troublesome that there were more broods than one; some, as Mr. Hadley, supposing there were "five or six generations." It is a quite common opinion, and it is held by many to the present day, that there are three broods.. This belief arises very naturally from the fact that those which hibernate appear in the spring to deposit eggs; the perfect insects from these are counted as a second brood, the fall brood being the third, according to the method of counting; but as will be seen by careful observation, those which appear in the spring are the same ones seen late in the fall.

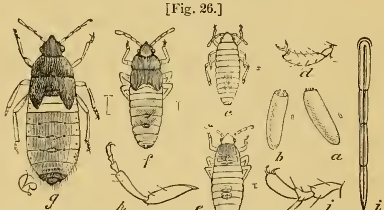
[Fig. 25.]

CHINCH-BUG: Hair line underneath showing natural length (after Riley).

Dr. Shimer observed in 1864 and 1865 that this species is two-brooded, but no account of his observations were published until 1867; in the mean time Prof. Riley published the fact in 1866 that they are but two-brooded in the northern part of this State (Illinois). Subsequent observations have shown this to be the rule in the other parts of the State and throughout the north-west. There is some evidence of an occasional third brood in the extreme southern part of the State, but not sufficient to justify me in asserting it as a fact, or to satisfy me of its correctness.

Insects may pass the winter as eggs, which is a very common method; as larvæ or young, which is rather unusual; as pupæ, which is a very common method in those orders where the pupa state is one of complete quiescence; and lastly, they may pass the winter as perfect insects.

[Fig. 26.]



IMMATURE STAGES OF CHINCH-BUG: *a*, *b*, eggs; *c*, newly-hatched larva; *d*, its tarsus; *e*, larva after first molt; *f*, same after second molt; *g*, pupa—the natural sizes indicated at sides; *h*, enlarged leg of perfect bug; *j*, tarsus of same still more enlarged; *i*, proboscis or beak, enlarged (after Riley).

The last method is the one adopted by the Chinch-bug. When cold weather comes on those of the fall brood leave the now dry and hardened corn stalks and seek secure places in which to remain during the winter. Occasionally they take flight at the time, but usually they seek the most secure places which can be found in and immediately around the field. Any rubbish left in the field, if of a nature to meet their wants, is eagerly sought; corn shocks, straw piles, stumps, logs, and fence rows are used as hiding places; they even hide beneath the clods when no better places can be found. But many move

* From Bulletin No. 5, U. S. E. C., by Prof. Cyrus Thomas.

into the forest, grove or woodland, if either happens to be near at hand. I have found also that the line of bushes along any stream traversing the field is a favorite resort. Sheds, barns, rail fences, and stacks often furnish them with winter quarters.

During the winter they remain in a torpid or semi-torpid state, but are easily warmed into life and activity. As the cold weather becomes more and more severe they press deeper and deeper, if possible, into the inner recesses of their hiding places. They prefer dry quarters if readily obtained.

Whether the males survive in equal numbers with the females is a point not ascertained so far as I am aware, but I am of the opinion that the females are the more numerous.

Their time of coming forth in the spring depends upon the latitude and season. In a few instances in unusually early springs they have been seen as early as the middle or latter part of March in the southern part of the State; while on the other hand, in the northern part of the State in a late spring they have delayed their appearance until late in May, and probably even until the first of June. Usually they come out during the month of April in the southern and central part of the State. But it must be admitted that there is but little testimony on this point, as but very few of our farmers pay attention to insects except when they become injurious or appear in immense masses. The Chinch-bug, when flying, would scarcely be distinguished by the unpracticed eye from a gnat. On this account our correspondence, and the printed and manuscript notes we have examined, make far more frequent mention of the first appearance of the young than they do of the spring appearance of the hibernating brood.

In order to show the various hiding places they select in which to hibernate, I quote the following notes from correspondents as found in my second report:

"When winter set in they went into winter quarters under corn shocks, clods, rails, etc."

"I have never known them to winter in timothy or any tame hay, but if you want to raise an extra crop of bugs, leave a few bottoms of prairie haystacks, and piles of corn fodder and straw until June, and my word for it you will have them."

"Their winter quarters are old rail fences, corn stalks, house-roofs, logs, leaves, etc."

In addition to these places we may add that in timbered sections they frequently go to the woods and seek shelter under the leaves and in the crevices of the bark of trees, under loose bark, and even under stones. I have found them quite abundant in old stumps and old logs and around corn fields which had been in corn during the summer previous. When no other hiding place can be found they will seek shelter from the cold under clods of earth.

As the cold increases they will penetrate farther and farther into their recesses. They prefer comparatively dry situations, as moisture appears to be inimical to them, though in this stage of their existence it does not appear to be necessarily destructive of life, as the following statement in my second report, given by a correspondent on whose veracity and intelligence I can rely, will show:

"They have been taken from ice, by thawing it, and when slightly warmed would manifest signs of life, crawling about as in spring. They thus appear to be able to endure cold or heat."

I have often taken them in winter inclosed in a covering of frost and to all appearance frozen stiff; yet when placed in a warm atmosphere for a time, they would survive. The following statement by Dr. Henry Shimer of Mt. Carroll, Ill., in reference to their winter life, will be interesting in this connection:

"After the early autumn frosts, they left their feeding grounds, on foot, in search of winter quarters; none could be seen on the wing, at harvest time. For a winter retreat, they resorted to any convenient shelter they might chance to find, as long grass, weeds, boards, pieces of wood rails, fallen tree leaves, etc., etc.

"In January, 1865, I next examined their condition; those that I found in the sheathes of the corn leaves above the snow,

and had been thus exposed during the previous severe weather—when for several successive days the thermometer was 15°–20° below zero—were invariably found dead, without exception, and those beneath the snow were alive. This observation was made in the common farm cornfields, as they might be found anywhere all over the wide country; for in autumn the Chinch-bugs remain in great numbers in the corn husks, and under the sheathes of the blades, as well as in other winter retreats. Upon various occasions, as the winter advanced, I brought in corn husks, filled with ice, inclosing the Chinch-bugs in the crystallized element; when the ice was thawed, they were able to run, apparently unaffected by that degree of cold. It is therefore proved that these insects possess vitality sufficient to withstand the effect of a temperature below the freezing point, and perhaps below zero, as must have been their condition in these ice-bound husks; but when in the open air, exposed to the sweeping prairie winds, 15 or 20 degrees below zero, for a long time, they succumb to the cold.

"March 7, 1865. The snow having cleared off from the ground, I examined the condition of a host of these Chinch-bugs that had chosen for their winter covering cord-wood sticks lying on the ground, entirely surrounded by frost and ice; of these 20 per cent. were living; those that were more fortunate in their selection of winter quarters fared much better. From a single handful of leaves, picked up at one grasp from beneath an apple-tree, I obtained 355 living and 312 dead Chinch-bugs; and of their lady-bird enemies that had entered the same winter quarters with them, 50 were living and 10 were dead. Of these Chinch-bugs I placed a number in comfortable quarters in the house, in a small paste-board box—not in a stove room—together with some Coleopterous insects, casually gathered among the Chinch-bugs; after one month I found the latter all dead and the former living.

"The entire month of March was rain, snow, thawing, freezing, alternately, seeming to be very uncomfortable for any living creature to remain out of doors, so poorly sheltered, and on top of the ground.

"April 1–6, I again made repeated examinations of these Chinch-bugs in their winter quarters, and found about the same proportion of them living as noted on the 7th of March. At this time they wandered away, on foot, from their winter quarters."

THE RELATION BETWEEN INSECTS AND PLANTS, AND THE CONSENSUS IN ANIMAL AND VEGETABLE LIFE.*

BY LESTER F. WARD, A. M., WASHINGTON, D. C.

(*Continued from p.* 67.)

It is a fact of profound significance that the higher flowering plants made their first appearance on the globe simultaneously with the *Hymenoptera* and *Diptera* in the Jurassic and Cretaceous formations, while they did not reach their highest perfection until the *Lepidoptera* had appeared in the early Tertiary. The *Neuroptera* and *Orthoptera* which are found in the Carboniferous could have contributed nothing to the demand for cross-fertilization, and the *Coleoptera*, sparingly met with below the Trias, were doubtless then equally ineffectual in this respect; as even at present they only supplement to a slight degree the work of the bees, flies, moths, and butterflies. And we accordingly find that the vegetation prior to the Jurassic and Cretaceous epochs consisted almost wholly of Cryptogams and Gymnosperms, with only a few amentaceous and monochlamydeous Angiosperms in the highest of these strata.

These facts justify the assumption that most of the higher flowering plants would speedily perish were insect aid withdrawn, and also that but for such aid in the past we should now see, instead of our gorgeous flora of Orchids, Lilies, Magnolias, and Roses, one consisting chiefly of Ferns, Cycads, and Conifers, mingled with willows, oaks, and alders, and plain grasses and rushes.

But when we consider how poorly adapted Cryptogamous and Coniferous vegetation is to the support of animal life, we may also declare with perhaps equal certainty, that but for the *Phaenogamia* there could have been no *Mammalia*. A picture that should represent herds of buffaloes and antelopes roaming amid the Ferns, Lepidophytes, and Calamites of the Carboniferous epoch would be an anachronism whose realization it would be impossible to conceive. And thus we have, only on a grand scale, one of those singular chains of cause and effect of which naturalists have pointed

out several (that of the dependence of clover upon cats, being perhaps the most familiar), but which, apart from that grotesqueness which they sometimes possess on a superficial view, are among the best illustrations of that intimate and far-reaching *consensus* which pervades all departments of life.

Considering to what extent man is dependent upon the *Palmaceæ*, *Rosaceæ*, and other fruit and nut-bearing trees and plants, which, at least on the theory of man's simian origin, must have been far greater if not absolute in the early period of his existence; considering, too, in connection with this, that it is the *Hymenoptera* that have contributed most to render the existence of this class of vegetation possible, it ceases to be a mere poetic fancy to claim for the bee and the ant the high merit of having literally prepared the way for the advent of man, whose prototype they are to so great an extent, both in their psychic and their social attributes.

The works of Darwin, Lubbock, Hildebrand, and Hermann Müller, contain an immense array of evidence bearing upon this interesting subject of cross-fertilization by insect agency, and I will only refer to a few typical cases peculiar to this country, and for the most part omitted in those works. Our American flora certainly presents as promising a field for this line of research as that of any other portion of the globe. Our Orchids are more varied and beautiful than those of Europe, and their peculiar forms doubtless embody lessons not yet imparted to man. The *Asclepiadaceæ* of which we have a rich abundance, depend wholly upon insects to extricate the pollen-masses from the deep cells in which they would otherwise remain permanently imprisoned. Our Mountain Laurel, *Kalmia latifolia*, has its anthers embedded in pits in the corolla from which, when freed by insects working at the nectar tubes below, they fly back by the elastic spring of the filaments, and cast their pollen to distant flowers. *Houstonia purpurea* and *H. cærulea*, as also *Mitchella repens* and other *Rubiaceæ* furnish marked examples of heterostyly, while cases of dichogamy are common among the *Geraniaceæ* *Umbelliferæ*, *Compositæ* and *Gentianaceæ*.

Science is indebted to two distinguished citizens of St. Louis, for the double discovery that our beautiful *Yucca filamentosa* is fertilized wholly by insect agency, and that this is accomplished by a single species of insect without whose services it can not bring forth fruit.

Most of you doubtless remember the brilliant paper by Prof. C. V. Riley, read at the Dubuque meeting of this association in 1872, in which these discoveries, the first made by Dr. George Engelmann and the second by himself, were announced, and *Pronuba yuccasella* was formally christened.

This case has an especial interest in connection with the general subject of this paper, since it illustrates more pointedly than any other within my knowledge, the nature of that *consensus* which exists between the insect world and the world of flowers, and at the same time forcibly demonstrates the necessity of studying these two sciences in connection.

Without enumerating additional instances, I may be permitted to refer to my own recent observations on *Sabbatia angularis*, whose curious behavior seems to me to admit of no other interpretation than as designed to secure the prevention of self-fertilization.

This flower, which is very showy and handsome, contains 5 stamens with elongated, sagittate, introrse anthers, which are abruptly curved outward near the summit, and a single style about as long as the stamens terminated by a forked stigma nearly as much longer, the commissure being often visible as a distinct line to near the base of the style.

These branches of the style which are stigmatic on the inside, are at first closely twisted together in such a manner as to conceal the stigmatic portion. They afterwards untwist and present the simply bifurcate appearance.

The plant is protandrously dichogamous and this untwisting of the stigma lobes does not take place until the anthers have

shed their pollen, so that the pollen of later flowers must be conveyed by insects to the stigmas of earlier ones. But in addition to this, the style itself is abruptly bent near the base, so as to form an angle of from 45 to 90 degrees with the perpendicular, carrying the stigmas far away from the stamens and usually locating them between the lobes of the corolla. Still more remarkable, however, is the fact that in most cases the stamens also are bent, but always in precisely the opposite direction from the style, so as to lean conspicuously away from the center, and it was not difficult to find flowers in which these peculiarities were carried so far that both the style and all the stamens were found lying flat upon the floral envelopes and pointing in opposite directions. Later, however, and after fecundation has taken place, both the style and the stamens partially or completely resume the vertical position. *

The aid which insects render to plants in procuring cross-fertilization is not their only service in return for the work of assimilation performed by the roots and leaves which constitute the plant the true producer in the organic economy. Many of them sacrifice their lives to the needs of the plant and the plant appropriates the bodies of its insect prey as systematically as does the swallow or the fly-catcher. If the great mass of insects, along with other animals, devour plants for their sustenance, so do certain plants as regularly devour insects for their sustenance, and not a few are the cases in which the imago pays back to the plant with its life and its body the board-bill which it contracted in the larval state.

This fact which was so long denied and then doubted, is now, thanks to the labors of Charles Darwin, fully established, and it exhibits another important side of that closely-woven web which holds the two kingdoms together.

The number of Insectivorous Plants is far greater than was at first supposed possible, and it is by no means probable that all of those endowed with this attribute, even among species systematically well known, have yet been recognized as belonging to this class.

There are two distinct ways in which plants appropriate insects, for the entrapping of which many remarkable devices exist. One method is almost wholly analogous to that by which the same function is performed by animals and constitutes a true digestion, the insect being decomposed by the action of a gastric juice, and the materials already assimilated passing directly into the circulation of the plant. The other method consists in the absorption by the roots and lower parts of the plant of the highly nitrogenous liquor formed of the decayed bodies of insects dissolved in rain-water. The first class utilize the insects as *food*, the second as *manure*. Exhaustive experiments have proved that in both these ways the plant is benefited and a true nourishment derived. Plants of this kind, of necessity, partially lose their power, both of radical and of parenchymatous assimilation, and become in so far parasitic, but strange as it may sound, parasitic on animals.*

Interesting as are these physiological facts, the morphological changes which take place in plants to adapt them to insectivorous habits, are if possible still more remarkable.

As in cross-fertilization it is the flowers, so in insectivorous plants it is the leaves which exhibit these modifications and perform these functions. The leaves of insectivorous plants are usually radical, and the organic matter derived from the bodies of insects finds its way through their porous petioles to the region of the roots, whence it enters directly into the circulation, as if taken from the soil.

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* Since the presentation of this paper and the subsequent publication of my observations in the *Gardener's Monthly*, it has been kindly pointed out to me by Prof. Asa Gray that the dichogamous ("*protandrous*") nature of several Sabbatias *(S. chloroides, S. stellaris &c.)* as well as the peculiar position of the style, had been previously noticed in his works. "The opposite position of the stamens," he however adds, "is quite new to me. * * * "We had not noticed this in the stamens of *S. chloroides* nor in *S. stellaris*." My observations were repeated in 1879 and the results, accompanied by drawings, were communicated to the Association at its Saratoga meeting. They fully confirmed the above description.

* *Empusa muscæ* is a kind of mould parasitic on the house-fly.

Mr. Darwin, in his excellent work on *Insectivorous Plants* has described most of the species then known. He has, however, omitted several of our American species belonging to the second class, or manure-generating plants. Of these I may mention *Sarracenia purpurea*, the well known pitcher-plant. Its brown-purple color denotes that it lacks the usual supply of chlorophyl, and its singular pitcher-shaped root-leaves generally contain a dark fluid with numerous drowned insects in all stages of decomposition. The stiff bristles on the inner face of the so-called "hood" have been described, but the much longer and slenderer hairs at the bottom or small end of the pitchers seem to have been overlooked.* These cover the inner surface of the pitchers, commencing at the base, extending about one-fourth of the way to the top, and terminating abruptly all round at the point where the pitcher begins rapidly to enlarge. I found them all closely appressed with their free ends uniformly pointing downward, and although they are more slender than would be thought most effective, there can be little doubt that they constitute an efficient snare for small insects venturing down into the narrow portion to which they are attracted by a savory secretion.

In Darlingtonia, an allied genus from the Pacific coast, an excellent description of which may be found in the *Botany of California*, the mechanism for accomplishing the same purpose is still more complicated and well illustrates the astonishing lengths to which morphological modification may be carried to secure these apparently unnecessary ends.

Cuphea viscosissima, a little plant in the natural order *Lythraceæ*, and a congener of the common garden Cigar-plant, is, as its name implies, "most viscid" throughout its stem and branches, which are densely covered with gland-bearing hairs. These serve as effective fly-traps, being usually found more or less covered with small gnats, and I have more than once found full-sized flies adhering by their feet. Although it is difficult to understand how this plant succeeds in utilizing the prey thus caught, it is perhaps more difficult to believe that all this cruelty is entirely wanton and purposeless. But aside from optimistic considerations, it is not easy to account for the development of any wholly useless mechanism. The reddish color of the stem of this plant marks a deficiency in chlorophyl and points in so far to a probable partially parasitic habit, and though no movements take place in the glands,* an internal circulation and "process of aggregation" may reasonably be assumed to go on.

America furnishes in *Dionæa muscipula* the most perfectly adapted insectivorous plant known to botanical science. Its wonderful mechanism and behavior have been faithfully portrayed both by Mr. Wm. M. Canby and Mrs. Mary Treat, as also by Mr. Darwin, and my own limited observations upon it simply confirm, so far as they go, the results obtained by them. I mention it merely as an illustration of the rich field which this country presents for the investigation of all these questions.

The entire subject-matter of this paper is without a specific designation or name, and without a place in any existing classification or curriculum of the sciences. We have zoölogy, and we have botany, and we have entomology, but neither of these embraces any of the above-named phenomena, or at most, only half of each phenomenon.

I should therefore fail to justify its presentation were I not to point out, in conclusion, the importance of bringing botany and entomology, at least into more intimate connection. The botanist who is unfamiliar with insect forms is never attracted by them when seen in and around flowers, drowned in the troughs, or caught in the viscid secretions of insectivorous plants. Thus the observation is only half made. I state this as a confession, and it is a confession which every thought-

*Prof. C. V. Riley has observed and describes similar hairs in *Sarracenia variolaris*. See Proc. A. A. A. S.

* Prof. Thomas Meehan, "The Native Fowers and Ferns of the United States," Vol. 1, p. 43.

ful collector in either field must have often made to himself. The collector must know his plant as well as he knows his insect, and *vice versa*, in order correctly to interpret either the peculiarities in the form of the one or the peculiarities in the conduct of the other. However it may be with other departments of biology, the importance and the feasibility of combining as one science or specialty an acquaintance, systematic at least, with plants and insects, or if this be thought too much, such an acquaintance with Phænogamous plants and with the *Lepidoptera*, *Hymenoptera* and *Diptera*, cannot be doubted. In no other way can the proper observations be made to exhibit the true relations which subsist between these organisms. It is a rare occurrence that a botanist and an entomologist collect in company, and should they do so, the results would still be less satisfactory than where both are combined in the same individual. Far be it from me to urge a departure from the practice of choosing specialties and mastering such specialties. In no other way can true excellence be attained. Neither is it often possible to make all forms of life a specialty. There will never be many Charles Darwins. But considering the remarkable interdependence which I have sought to point out between certain entirely dissimilar forms of life, which obviously can never be fully understood by specialists in any one department, it seems a necessity, if we would ever understand these questions, to combine the study of portions of two of these departments into one specialty and to prosecute them conjointly. There could thus be secured a corps of competent workers, specialists in this field, without which no great subject can ever be thoroughly canvassed.

Zoö-phytology, or the science of the relations which subsist between animals and plants in general, is an ideal science whose general aspects only can be grasped by a few minds of high synthetic capacities. But Entomo-phytology, or the science of those relations of interdependence existing between certain insects and certain plants, and which may be said to embrace the three subjects of galls, cross-fertilization of flowers, and insectivorous plants,—this science, when pruned of everything not necessary to the investigation of the problems to which this interdependence and reciprocity give rise, may certainly be regarded as a practical one whose pursuit would be attended with abundant success

THE INSECT ENEMIES AND DISEASES OF OUR SMALL FRUITS.

[Read before the New Jersey State Horticultural Society, Jan. 16, 1880, by A. S. Fuller.]

[*Continued from p.* 63.]

As the Raspberry is closely allied to the Blackberry and belongs to the same genus, the diseases and insects infesting both do not materially differ. Some few species of insects seem to prefer the Raspberry, notably among which is what is called the Red-necked Buprestis (*Agrilus ruficollis*, Fig. 27), a small beetle that seems to be particularly fond of the red and black-cap varieties, but will occasionally attack the Blackberry. The larva (Fig. 29) bores the canes in summer, causing large excrescences or galls (Fig. 28), checking the flow of sap, and causing the death of the cane. This insect seems to be far more plentiful in the western than eastern States ; but it is widely distributed, and every cultivator of the Raspberry may as well be on the lookout for it, and gather and burn all canes upon which galls of any kind are found.

[Fig. 27.]

Agrilus ruficollis.

The snowy Tree-cricket (*Œcanthus niveus* Harris, Fig. 30), is another insect that appears to prefer the canes of the Raspberry as a nidus for its eggs to the twigs of other shrubs or trees. It will, however, use the Grape, Willow, Peach, and other kinds, if Raspberries are not convenient. The long, slender eggs are deposited in a close compact row, an inch or more in length, each egg placed at a slight angle, and deep enough to reach the pith of the cane or

twig in which it is set (Fig. 32). This weakens the canes, and they are often broken off by the wind. This injury does not amount to much, but the perfect insect has a very bad habit of cutting off leaves in summer; and sometimes extends its mischievous work to the grape-vine, trimming off both leaves and fruit, working at night when perfectly safe from observation or molestation. One of my correspondents in Texas wrote me, a few years ago, that one of these pests would completely defoliate a young grapevine in a single night, and he was a long time in discerning the successful nocturnal pruner, and when discovered he was at a loss how to circumvent it. Destroying the eggs is the only way I know of fighting this insect.

[Fig. 28.]

Gall produced by Agrilus ruficollis (after Riley).

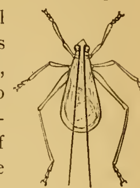
The Currant and Gooseberry.

After two or three centuries of almost entire exemption from noxious insects, it is no wonder that our people came to look upon the Currant as a fruit for everybody, and one that could be raised in almost any corner of the garden without care or cultivation; but all at once and without warning, not only did its ancient enemy from the other side of the Atlantic appear in this country and commence its destructive work, but several native species of insects joined in making havoc with our Currant and Gooseberry bushes. First, the Imported Currant Worm (*Nematus ventricosus* King, Fig. 33) made its appearance about Rochester, New York, in 1857; then it was soon discovered that we had a Gooseberry span-worm (*Eufitchia riberaria*, Fitch), the former being the larva of a four-winged fly, and the latter the caterpillar of a small moth. These two species spread with great rapidity, and seemed for a while to defy all the usual insecticides and other methods of destruction. Then the late Mr. Walsh of Illinois discovered a native saw-fly, the *Pristiphora grossulariæ*, which was also double-brooded like its European congener, and fed upon the Currant and Gooseberry, rather preferring the latter. With these three insects; with a borer or two that perforates the stems of the plants, and several species of plant-lice infesting leaves, roots, and green shoots, the cultivators of the Currant and Gooseberry have had all they could do to keep their plants alive, and obtain even a moderate crop of fruit. As all these Currant and Gooseberry pests have been very fully described in the writings of Fitch, Walsh, and Prof. Riley, I will not detain you by repeating any part of the same, but merely say that for the different species feeding on the leaves, nothing has been discovered better in the way of destroying them than powdered white hellebore. A few dustings

[Fig. 29.]

Larva of Agrilus ruficollis (after Riley).

[Fig. 30.]

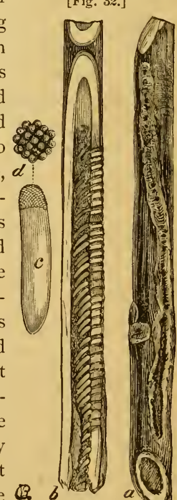


Snowy Tree-cricket, male.

[Fig. 31.]

Snowy Tree-cricket, female.

[Fig. 32.]



Eggs of Snowy Tree-cricket:—*a*, stem with punctures; *b*, section of same; *c*, egg enlarged; *d*, granulations at tip, more highly enlarged (after Riley).

with this, at the proper time, will usually destroy these pests. Hand-gathering may also be practiced, as well as frequent cultivating the ground among the bushes, in order to unearth the worms that have passed into it to undergo their transformation.

The common Currant stalk-borer (*Ægeria tipuliformis*) is well known to all growers of this fruit; at least the larva or grub is, which may be found in the canes during the fall and winter months, and during this time all infested shoots should be cut and burned with their contents. There are also one or two other species of Currant-

[Fig. 33].

IMPORTED CURRANT WORM:—*a*, *a*, *a*, larvæ in different positions; *b*, side of a middle joint enlarged, showing arrangement of tubercles (after Riley).

borers, but as they are all found in the stems during winter, one method of destroying will answer for all.

The diseases of Currants and Gooseberries are mainly climatic, consequently difficult to prevent or cure. Mildew on the Gooseberry is the one most dreaded, and the better way is to avoid it by cultivating only those varieties that are adapted to your soil and climate, and the native ones are preferable to the foreign on this account. In cool, moist soils, or with a liberal amount of mulch and thinning out of the heads of the plants, the European varieties may be occasionally made to succeed moderately well.

(To be continued.)

THE COTTON WORM IN THE UNITED STATES.*

The paper records some of the scientific results of the inquiry respecting the Cotton Worm and other insects injurious to the cotton plant, begun by Prof. Riley while entomologist to the Department of Agriculture, and now being continued by him under the auspices of the U. S. Entomological Commission. Among the incorrect statements that have hitherto been made, and opinions that have obtained, regarding the habits of the Cotton Worm, the author mentions, 1st, that as to the first appearance of the young worms as late as the last of June or later in the season in the canebrake country of Alabama; 2nd, the so-called sudden appearance of the worms in great numbers over large districts; 3d, the idea that there are but three annual generations; 4th, the belief that the species has no parasites.

Three of these opinions were iterated in an interesting paper read by Prof. A. R. Grote, at the 1874 meeting of the Association, and were emphasized by the announcement that the paper was based on a residence and experience of five years in cotton-growing States. Prof. Riley finds that the opinions are erroneous in that, *firstly*, the first worms hatch in April in Southern Georgia and Alabama; that, *secondly*, the first generation appears in spots and generally in such small numbers as to be easily overlooked, and that in subsequent generations the worms disperse and increase more or less rapidly, according as the surrounding conditions are favorable or otherwise; that, *thirdly*, there are from six to eight annual generations in the Southern portion of the cotton belt; and that, *fourthly*, the species is attacked by at least ten distinct parasites, some of which are quite efficient in keeping it in check. In addition to two not yet reared to the perfect state, the following are enumerated: From the egg of Aletia—*Trichogramma pretiosa*, n. sp.; from both larva and

*Abstract of a paper read at the Saratoga meeting of the American Association for the Advancement of Science, by C. V. RILEY.

pupa—*Tachina aletiæ*, n. sp., and *Sarcophaga sarraceniæ* Riley; from the pupa alone—*Pimpla conquisitor* (Say), *Cryptus nuncius* Say, *Chalcis ovata* Say, *Cirrospilus esurus*, n. sp., and *Didictyum* (n. gen.) *zigzag*, n. sp.* Regarding the theory of the annual dying out of the insect in the States, and the consequent annual migration of the moth thereto from some exotic country—a theory largely based on the above mentioned erroneous opinions, and which Prof. Grote made his own in the paper referred to—Prof. Riley states that the theory was first suggested by Mr. Robert Chisolm of Beaufort, S. C., but first fully propounded in 1847 by Dr. D. B. Gorham in DeBow's Review.† In 1854 it was again set forth by Dr. W. I Burnett in the Proceedings of the Boston Society of Natural History.‡ The facts collected during the past year strengthen the belief that the moth hibernates with us, and that no such theory is necessary to explain the phenomena connected with its annual development. Its comparative absence during some years and its prevalence in injurious numbers during others, are dependent on the same natural conditions which govern the same phenomena in many species injurious to vegetation, and notably in the case of the Northern Army Worm (*Leucania unipuncta*).

Prof. Riley finds it convenient to divide the cotton belt into 1st, the southern or permanent portion, where the first worms annually appear and the moths in all probability hibernate; 2d, the northern or temporary portion, in which the insect does not hibernate, but into which it spreads, either by gradual dispersion or by more sudden migration, from the permanent portion. The dividing line between these two portions must needs be difficult to define, because there is an uncertain region that may, according to season or circumstance, belong to either, and also because of the limited observations that have yet been made. Taking the early appearance of the worms as a basis, the southern portion may be thus roughly defined: Beginning with Texas, it includes the region south of the Galveston, Harrisburg and San Antonio Railroad, excluding perhaps the extreme western portion, but extending somewhat farther north along the river bottoms. In Louisiana and Mississippi it includes the valley of the Mississippi River and its tributaries, with uncertain northern limits. In Alabama it is represented by the limestone cotton belt south of Montgomery, though probably extending farther north to the east of that point. In Georgia it does not extend north of Albany on the west, but doubtless includes the sea islands along the coast, as also those of South Carolina, though at the present time cotton cultivation is limited principally to Saint Catharine's Island. In Florida it includes all parts where cotton is grown.

While the theory of annual immigration does not apply to the first or southern portion, Prof. Riley believes that it does apply to the northern portion, and that the insect is there killed out each winter; so that some of Prof. Grote's arguments have force if restricted to this more northern portion of the belt.

The interesting fact is recorded that the cotton plant furnishes not only the natural food of the larva, in the leaf; but likewise that of the moth, in a sweet liquid exuding from certain glands on the underside of the leaf, and at the base of the outer lobes of the involucre: also that the tip of the proboscis in the moth is admirably adapted to penetrate ripe fruit and that much injury is done to such by the moth. The fact that the first worms of the season usually appear in certain low, moist spots in a field, is explained by the sweet exudation being most copious and most attracting the parent moths there; also by the greater scarcity in such places of ants, which are very abundant in cotton fields and destructive to the worm when young, or molting, or enfeebled from whatsoever cause; while the more rapid development and multiplication of the insect during moist or rainy weather is explained

* These species have since been described in *Canadian Entomologist* (Vol. XI, p. 162) and Bulletin 3 of the U. S. Entomological Commission.

† Vol. III. pp. 535-43. ‡ Vol. IV, 316.

by the decreased efficiency of its natural enemies. Aside from the parasites mentioned, the worm is beset on all sides by enemies which cannot work so well during wet weather, and whenever the natural checks are hindered in their work the great prolificacy of the plant-feeder soon gives it the advantage in the struggle for existence. The conclusion is also arrived at, from certain futile attempts made to introduce the English sparrow into the South, that this bird cannot be acclimated there, and that while it will extend into the cotton belt during winter time it returns further north in summer, and dies when the temperature exceeds 100° Fahrenheit.

FURTHER NOTES ON THE GRAPE PHYLLOXERA IN CALIFORNIA.

We have received from Prof. E. W. Hilgard of the University of California a supplement to the biennial report of the Board of Regents, which contains over 100 pages of very interesting reading, and indicates the thoroughness and energy which the Professor of Agriculture and Botany has brought to the College of Agriculture. We quote some passages of his remarks on the Grape Phylloxera, which indicate the true status of things there, and are suggestive :

The situation a year ago may be summed up as follows : The ravages of the enemy have become manifest in a greater or less degree, from about six and a half miles above Sonoma Town to the lower end of the valley, a length of ten or eleven miles in all. Within these limits large tracts have been completely destroyed, the vines having been uprooted and grain sown instead for several years. It is difficult to ascertain the total area of vineyard that has disappeared, but it counts many hundreds of acres. On a still larger area, probably, the condition of the vines has become such as to render them unprofitable, so that they are being pulled up and used for firewood in the wineries. So far, no material difference in respect to the resistance of the several varieties has been reported, all those grown being of the type of the European vine (*Vitis vinifera*), grown on its own or kindred stock. The Mission vine, naturalized for over a century in California, is at least as badly attacked as is the Riesling, Zinfandel, Rose of Peru, or any other grown.

Amid the general devastation, nevertheless, there are some exceptions — green islands, apparently of healthy vines in good bearing, yet surrounded on all sides by defunct vineyards. This is even the case in the vineyard which first succumbed, where, nevertheless, some of the original vines still remain, apparently in good condition. A close study of these exceptions could not fail to lead to highly valuable results ; but to do so would require the whole time of a thoroughly qualified person for at least an entire season. In general it appears that great care of the vines, good tillage, and manuring have been practiced in all these cases ; but there are many others in which no amount of care or manuring has seemed to possess any perceptible efficacy, and where the destruction has been as swift as in the doomed vineyards of France.

Whatever may be the true explanation of these remarkable exceptions. the general fact remains that in four years the insect has spread no more than about two and a half miles up the valley, from a point of great virulence, notwithstanding the fact that this is the prevalent direction of the summer winds.

The natural inference from this fact would seem to be that from some climatic cause, the Phylloxera in California does not develop into the winged form, which evidently mediates its rapid progress in Europe ; and that its progress is here altogether dependent upon the transportation or migration of the wingless forms.

It would be most important practically, as well as most interesting theoretically, to verify this inference by observation ; but I have been unable as yet to obtain any observations on the subject, save as regards the general statement that no one has noticed about the infested vines any very small flies in July and August.

If it were definitely known that the winged form does not make its appearance, then it would follow that the pest can be stamped out by a concerted effort, by using those insecticides which, though locally effective, have failed to prevent the spread of the insect in Europe. Although too costly to be carried out by each one, such method could well be afforded by a community for the purpose of putting an end to the fearful evil, once for all. I mention in this connection the sulpho-carbonates, and the clay cubes impregnated with carbon bi-sulphide. It is true that a few dozen of the latter have been tried in a vineyard near Sonoma, with no perceptible effect ; but this cannot be a matter of surprise, since the mistake was made of putting them around *alternate* vines, so that the one intended to be relieved would in any case be promptly restocked fron its neighbors. The vines to be treated should, of course, have been entirely isolated, in order to render the experiment decisive.

As to the presence of the Phylloxera in other portions of the State, extensive inquiries have failed to satisfy me that it exists outside of the Sonoma Valley, save at one point, in Fresno County, where it was introduced with cuttings of choice grape varieties from Europe. The proprietor, recognizing the fact in time, and conscious of the danger incurred by one of the foremost industries in the State, has used every effort to confine the pest within his own vineyard, at a considerable pecuniary sacrifice.

It must be a subject of congratulation, that with the introduction of such a great number of grape varieties from foreign countries, a larger number of insect pests and diseases has not been introduced. On the whole it may be said that the vines of California are remarkable for their rapid growth, vigor and thriftiness.

It is noteworthy, in this connection, that so far the varieties derived from the native American grape, which are almost exclusively relied on in

the States east of the Rocky Mountains, are grown in California only as a matter of curiosity, or for table use at home. Their cultivation leaves open a wide field of future possibilities in varying and modifying the wine product of California, whose climate seems wonderfully adapted to the assimilation of the most varied cultures.

NOTES ON PYRETHRUM.

In the pamphlet above alluded to, Prof. Hilgard, after showing the importance of freshness in the use of this insecticide, remarks:

Like all volatile oils, the essence of *Pyrethrum* is slightly soluble in water; and I think, from my experiments, that the *tea or infusion, prepared from the flowers* (which need not be ground up for the purpose) is the most convenient and efficacious form of using this insecticide in the open air; provided that it is *used at times when the water will not evaporate too rapidly*, and that it is applied, not by pouring over in a stream, or even in drops, but *in the form of a spray from a syringe* with *fine* holes in its rose. In this case, the fluid will reach the insect despite of its water-shedding surfaces, hairs, etc., and stay long enough to kill. Thus applied, I have found it to be efficient even against the armored scale-bug of the orange and lemon, which falls off in the course of two or three days after the application, while the young brood is almost instantly destroyed. As the flower tea, unlike whale soap and other washes, leaves the leaves perfectly clean, and does not injure even the most tender growth, it is preferable on that score alone; and in the future it can hardly fail also to be the cheaper of the two. This is the more likely, as the tea made of the leaves and stems has similar, although considerably weaker, effects; and if the farmer or fruit grower were to grow the plants, he would save all the expense of harvesting and grinding the flower-heads, by simply using the header, curing the upper stems, leaves, and flower-heads all together, as he would hops, making the tea of this material by the hogshead, and distributing it from a cart through a syringe. It should be diligently kept in mind, that the least amount of *boiling* will seriously injure the strength of this tea, which should be *made* with briskly boiling water, but then simply covered over closely, so as to allow of as little evaporation as possible. The details of its most economical and effectual use on the large scale remains, of course, to be worked out by practice. But I have little doubt that its cultivation will prove an important acquisition to California, exposed as she is to the importation of the insect pests of the whole world.

Some observations reported to me seem to render it probable that the cultivation of the *Pyrethrum* between the rows of other plants will, in a great measure, protect these from the attacks of insects; as, of course the plants themselves are let severely alone by them. It might even seem worth while to try this plan against the Phylloxera, in so far as the winged insect could scarcely escape the deadly effects of the *Pyrethrum*, thus preventing its spread. It has been reported that a certain kind of sumac has thus served to save many of the vineyards of the Isle of Cyprus.

BIRDS vs. INSECTS.

BY EDOUARD PERRIS.

[*Concluded from p.* 69.]

[The remainder of this paper (excepting the parts in quotation-marks) has been freely translated and very much condensed. A discussion of the parasitism of insects has been wholly omitted.

While recognizing the fact that the considerations brought forward by the author are essential to a fair and complete idea of the services of birds, the translator does not wish further to commit himself to the views of Mr. Perris.—S. A. F.]

Taking up the orders of insects *seriatim* and referring first to the cockchafers, whose larvæ, known as white grubs, live on the roots of plants, the author calls attention to the fact that the mature insects, being nocturnal, are subject to destruction only by owls and goat-suckers. If we suppose all these birds to live exclusively upon cockchafers during their season, the number destroyed would amount to nothing practically, since the birds are so few and the insects so very numerous.

The larvæ, being subterranean, can be reached only by birds which dig up the ground, viz.: ravens, magpies, starlings and woodpeckers. Magpies and woodpeckers are too few and scattering to do any appreciable good. The ravens and starlings, however, gather in flocks in early autumn, and pass the winter in France and more southerly countries. Long observation of their food habits shows that they live at first on acorns, and on corn (maize) pilfered from the fields. At seed-time they forage the fields of barley and rye, probably picking up a few insects as they dig for grain. Later they scatter everywhere and live as they can. They resort especially to pastures and meadows where they pick to pieces the droppings of stock for fragments of grain and coprophagous larvæ. They also pick up grain, earthworms and hibernating insects, frequently digging into the ground a depth of 2 to 6 decimeters, but not by any means deep enough to reach the white grubs. These, in cold weather especially, retreat far beyond the reach of birds.

"I believe, then, that it is demonstrated that birds and cockchafers can live very

well together, and that the latter have nothing serious to dread from the birds."

The *Lucanidæ* (or stag-beetles) are not injurious, as they only attack dead or dying wood; and they are at any rate protected by their size and solidity when mature, and by their situation in the larval state.

Of the *Buprestidæ*, many attack plants of no value, or live in dead wood,—but some give the finishing stroke to trees which are merely unhealthy.

The females lay their eggs in crevices of the bark, on very hot days. At this season of the year only three kinds of birds search the bark of trees for food during the hotter part of the day,—creepers, nuthatchers and woodpeckers. But these are scarce, and besides, are not at hand just at the proper time to defend the invalid tree, since they find an abundance of food everywhere. During the winter, the woodpeckers and titmice eat a great many of the Buprestid larvæ which work beneath the bark, but nothing can reach those which penetrate the wood. These are, indeed, the most useful of birds,—but they require no protection, because no one hunts them.

The *Anobii*, although often very destructive, are domestic beetles, and consequently not exposed to birds.

The great snout-beetle family, although it includes an immense number of species and countless individuals, contains comparatively few enemies to man. A *Rhynchites* causes the destruction of a few grape leaves, but does no appreciable harm. Another girdles young shoots of pears and quinces in whose tips it has laid its eggs and may thus do some injury, although it usually merely helps to prune the trees. These insects have a very hard crust, and, lost among the leaves, can seldom be found by birds, while their larvæ are not molested at all.

Another weevil, called the *Grisette* (*Peritelus griseus*), much commoner and more noxious, destroys the buds of fruit trees; but the birds cannot affect it, because it is of nocturnal habit, and spends the day underground, or hidden among the leaves and lichens.

Species of *Polydrosus* and *Phyllobius*, injurious to young buds of the pear and apple, hide in the foliage, and are concealed by their small size, their color and their immobility. The same is true of *Balaninus* (nut-weevils), whose larvæ live in nuts and acorns. The birds discover a few of them, but the larvæ are completely protected,—especially as the birds distinguish and reject wormy acorns.

Two species of *Anthonomus* blight many blossoms of pears and apples, but probably do more good than harm by thus lightening the burdens of the trees,—only anticipating the labors of the gardener. At any rate, as they have the color of bark, and remain hidden and inactive during the day, they do not attract the attention of the birds, and their larvæ are wholly out of sight.

Hylobius and *Pissodes* are destructive of conifers, and a few are probably caught among the leaves; but they spend most of their time on the bark whose color they simulate. During the winter, one often finds dead trees riddled with the holes made by titmice (*Mesanges*) and woodpeckers in relieving them of a part of the larvæ which have destroyed them:—after death, the doctor!

Species of *Ceutorhynchus* and *Baridius* are destructive of cabbages, turnips, etc., but are too minute to be taken by birds, while their larvæ are hidden within the plant. The destructive grain-weevil, *Sitophilus granarius*, found in stores of grain, is of course unmolested by birds. No ornithophile has yet ventured to suggest that the sparrows, which enter the granary whenever they can, are attracted there by the search for weevils.

Other weevils, attracting only dead wood, too minute for notice, nocturnal in their habits, and, as larvæ, out of the reach of birds, need not be further specified.

The author here gives a condensed account of the habits of the *Scolytidæ* (bark-borers), whose ravages are a very serious matter in Europe. The most dangerous

species mine in the liber, where they lay their eggs. The larvæ continue the galleries thus formed by the female and transform beneath the bark. The adults of some species also eat the buds of evergreens, so mutilating the tree as usually to effect its destruction in the end. These noxious insects are of small size, varying from half a millimeter to six millimeters in length, they are all of a dusky hue and are nocturnal in their habits, remaining buried in the wood or beneath the bark by day. Their larvæ are of course always hidden, and are subject to the attack of woodpeckers only.

The *Bruchidæ* (or weevils), which infest peas and other leguminous seeds, do not seem to be noticed by birds, and the author has seen infested by *Bruchus* beds of peas in which the linnet (*fauvette habillarde*) had built its nest. Sparrows are often seen among the vines, but they destroy the peas themselves.

"The sparrow is a pillager who carries on his depredations in the harvest-field, in the garden, in the granary, and among the ripe grapes on our trellises; and I cannot join in the kind of worship paid him by certain persons more credulous of his pretended utility than struck by his instinct of rapine and waste."

Almost all of the *Cerambycidæ* (wood-borers), are lignivorous, but the great majority of them feed only on dead wood or on trees too unhealthy to have any great value. The ravages of the injurious species are readily controlled by man, as it suffices to cut down and bark the dead trees. The larvæ of this family live always under cover, and the adults are many of them nocturnal and many of them large enough to take care of themselves. A few of the smaller or medium-sized individuals are doubtless eaten by birds, but in too small numbers appreciably to diminish the mass.

Among the *Chrysomelidæ* (leaf-feeders), are mentioned *Colaphus ater*, a scourge in the fields of lucerne, neglected by the birds, which do not frequent these fields; certain *Galerucides* which attack the slum, but which no birds are known to eat, notwithstanding their immense numbers in some years; and *Halticides* which injure young cabbages, turnips and beets, but are of so minute a size that a bird would disdain to open his beak for one of them.

The author does not regard the non-migratory grass-hoppers and locusts as sufficiently harmful to make their destruction by birds a matter of especial importance.

Of the *Neuroptera*, all are entirely inoffensive except the white ants, Termites, and these "laugh at the birds." Only the winged form is exposed to them in May.

Among the *Hymenoptera*, only the Saw-flies, Horn-tails, Ants and Wasps are especially mentioned. Of the first two families it is admitted that birds eat a few, but their larvæ are usually not exposed. Ants are regarded as annoying rather than injurious. They eat fruit, but only that which has been previously injured. Although many are eaten, they are nevertheless abundant everywhere.

Wasps are usually able to take care of themselves. The hornet is an especially annoying pest, catching bees and eating grapes and other fruits.

The *Hemiptera* are next reviewed. A pernicious cabbage bug (*Strachia oleracea*), although conspicuous by its brilliant color, and working all day entirely exposed to the birds, is unmolested by them because it is not appetizing. M. Perris dwells upon the variety and extent of the injury done by plant-lice (including *Phylloxera*), describes their abundance and enormous fecundity, but says that birds do not amuse themselves with so minute a prey, and apparently do not like them, but are much more likely to pick out of a serried phalanx of aphides the larger larval *Syrphus*, *Coccinella* or Lace-wing, which is feeding upon them. The same remarks apply to the enormously destructive bark-lice as well. The Thrips, which sometimes blights the flowers of fruits and grain, falls likewise under the category of insects too minute to be noticed by a bird.

Among the *Diptera*, the *Cecidomyiæ* first demand attention. The plants upon which

these live are too various to enumerate, and only two species are especially mentioned;—*C. nigra*, which attacks young pears, and *C. tritici*, often very destructive to wheat. But in the wheat fields, at this time, there are no more than a few pairs of partridges, quails and larks, and the insects in question are, at any rate, almost invisible from their small size and their delicacy of form. The same may be said of other minute flies, which cause deformities in the young wheat stalks,—such as species of *Oscinis* and *Chlorops*.

Most of the horse and cattle-flies, including the bot-flies, etc., are protected from birds by their extreme agility.

Cherries, olives and oranges are attacked by flies, of which a few are probably taken by birds, but the larvæ can only be reached by eating the fruit they infest.

In short, it may be said of the *Diptera* in general that but a very small part of them are noxious, and that birds find an abundance of inoffensive flies for food, and do us little service.

The *Lepidoptera* embracing a much larger number of enemies, those most harmful are reviewed in some detail, to show to what extent they are exposed to birds.

Only the *Pieridæ* need be mentioned among diurnals. The services of a pair of chaffinches in cleaning a garden of cabbage caterpillars (*Pieris brassicæ and P. napi*), have been greatly vaunted, but with evident exaggeration. Chaffinches and other small birds avoid caterpillars as hairy as those of the *Pieridæ*. The larvæ of *Leucania cratægi*, injurious to fruit trees, live entirely exposed to the birds in summer, and in winter remain suspended in groups to the bare branches in purse-like structures made of leaves; but the birds respect them altogether. The caterpillars are too hairy.

The nocturnal *Lepidoptera* comprise many more exceedingly noxious species. *Hepialus humuli* devours the roots of the hop, *Sesia mutillæformis* lives beneath the bark of the pear trees, and *Aglaope infausta* (*Zygænidæ*) eats the leaves of the almond. *Clisiocampa neustria*, a very hairy caterpillar, living in societies, defoliates the apple and pear and often prevents their ripening fruit.

The processionary caterpillar of the pine (*Cnethocampa pityocampa*), which often destroys the foliage of an entire forest, and continues its ravages year after year, is inclosed during the winter in a tough nest, firmly attached to the leaves, and is also thickly covered with stinging hairs; *Liparis chrysorrhœa*, very injurious to fruit trees, is likewise hairy, and sheltered by a silky screen in winter. It is against this noxious and very common species that the laws requiring the destruction of caterpillars are chiefly directed. *Cossus ligniperda* devours the liber at the base of the trunk of willows, chestnuts and elms, often killing the trees by girdling them. *Zeuzera aesculi* mines beneath the bark and excavates the trunks and branches of pear and apple trees. *Triphœna pronuba* eats lettuce and other garden plants at night, but hides in the earth by day. Nearly all the garden *Leguminosæ*, the cereals, maize, tobacco and beets, fall a victim to the common cut-worm or green worm; *Agrotis segetum*, and *Agrotis exclamationis* are equally destructive. *Hadena brassicæ* devours the leaves of cabbage and even penetrates to the center of the head. *Heliothis armigera* and *Leucania zeæ* eat the kernels of young corn beneath the husk, and the former also attacks the kidney bean in the pod. The Pyralid, *Aenophthira pilleriana*, is so destructive to the grape as to have attracted the attention of the government, and *Cochylis roserana* is almost equally dangerous. The apple Pyralid, *Carpocapsa pomonana*, is the moth which makes pears and apples wormy, and causes often a general dropping of the unripe fruit. Others of the same genus similarly effect plums, ehestnuts, acorns and olives. Colonies of the caterpillar, *Yponomeuta malinella*, protected by a common web, gradually cover whole branches of the apple, completely denuding them of leaves flowers and fruit. Finally the grain moths, *Tinea granella* and *Butalis cerealella* do great injury to the garnered grain.

Now what relief from this host of enemies

may we hope from the birds? Each can answer this question for himself when he learns: 1st, that the moths of every one of the caterpillars mentioned above are nocturnal, adepts at concealment by day, and exposed, while active, only to a few goat-suckers and nocturnal birds of prey; 2d, that those caterpillars which develop under the open sky are very hairy, and respected by all birds except the cuckoo, and in winter the charcoal titmouse (*Mésange charbonnière*); 3d, that all the others, excepting *Hadena brassicæ*, and this for a few days only, live wholly concealed and protected from depredation, or else enveloped in webs which birds do not like to penetrate. Now what can a few cuckoos, goat-suckers and titmice do against such an innumerable population?

After this summary of incontestible facts, the following recapitulation of principles will stand some chance of being understood:

"1st. Birds are assembled in larger or smaller troops only at the period of the vernal and autumnal migrations,—that is to say, when most insects are infinitely less numerous than in midsummer. The remainder of the time they live in pairs, ordinarily scattered here and there, not common in cultivated fields, while the insects invade *en masse* the trees which they attack, the products of the soil of which they are the enemies.

"2d. Birds destroy enormous numbers of insects, but these insects are in great part innoxious, while some are eminently useful. The species really noxious are so few compared with the whole mass, that birds are really of little service. They may even injure us,—either by devouring our fruit or by eating grain in seed time or in harvest, but especially by killing so many carnivorous or parasitic insects, which render us the greatest service.

"3d. Those insects which give us most cause to complain are some of them large enough to brave the birds, others (and these are commonly the most formidable) too small to attract their attention, and still others offensive to the taste. Many are nocturnal and remain hidden by day, with an instinct of self-preservation as well developed as that of larger animals, or remaining motionless, are overlooked by birds, which perceive much more easily and pursue more willingly insects which fly or run; some live underground or in houses, and all are endowed with a fecundity which sometimes astonishes the imagination, and which, at all events, is such that man, with the most persevering and assiduous diligence cannot exterminate them even in a small field, cannot even relieve his house of them,—no, not so much as a single room.

"4th. The caterpillars and other larvæ which are especially injurious, nearly all live hidden under the earth or bark, within the wood, in the stems of plants, in fruits, in habited places, or under silken webs, and pay the birds only a slender tribute.

"Those which are exposed during their growing period are generally covered with hairs which repulse the birds; some are nocturnal, and disappear before day, and others are protected by their excessive minuteness.

* * * * * * * *

"Who does not see that, hunting insects without the least discernment, birds destroy, among many harmless species, many useful ones also, and especially parasites, which, almost wholly diurnal and endowed with great activity, are particularly liable to become their prey?"

* * * * * * * *

THE MIGRATIONS OF BUTTERFLIES.

The fact that many animals, especially rats, mice and lemmings, occasionally migrate from place to place in immense numbers is familiar, and abundantly recorded. These animals are not normally migratory but become so only as a result of excessive multiplication, and the migrating habit, when once developed, possesses some peculiarities not easy to explain, one of which is that the movement is usually very persistent in some given direction. Many insects that usually exhibit no migratory tendencies, likewise exceptionally con-

gregate and migrate in vast bevies, and numerous instances in several different Orders of insects might be cited. It has been especially noticeable in butterflies and moths, however, and European papers have lately very freely recorded the extraordinary abundance of *Vanessa cardui* and *Plusia gamma*, the flights and movements of which were a marked feature of the year 1879, and phenomenal. Such occasional migratory movements are beyond doubt a result of excessive multiplication, due to unusually favorable conditions for the development of the species, but the conviction has been of late years forcing itself upon our minds that, with some butterflies, there are regular annual migrations that are more to be likened to those of birds of passage than to the more erratic and irregular insect-flights alluded to.

The same laws which govern the movements of the Rocky Mountain Locust and cause it to move southward and southeastward during the latter portion of the growing season, and its issue to return in the opposite direction in spring and early summer, seem also to govern some of our more widely distributed butterflies. Numerous accounts of the flight in swarms of the common Milk-weed butterfly (*Danais archippus*) have been published, and, after collecting all accounts that we have been able to during the last ten years, of the movements of this butterfly in the Mississippi valley, the fact becomes apparent that there is an instinctive movement toward the south and southeast in the Fall of the year, and in the very opposite direction the ensuing spring. In the vast plains and prairies lying to the north between the Mississippi and the Rocky Mountains, upon the richer parts of which milk-weeds abound and *Danais archippus* more particularly flourishes and multiplies, there is a very general want of such protecting forest as will permit of hibernation, even if the butterflies could withstand the severe winter of the sub-boreal zone, in which they may be seen in such large numbers during the summer. The more densely timbered regions to the south and southeast, as well as the milder winters, undoubtedly offer more favorable hibernating conditions, and we believe that there is an instinctive movement toward these more favorable regions—a movement quite independent of the fact that the prevailing winds in late summer and autumn aid it.

[Fig. 34.]

DANAIS ARCHIPPUS (after Riley).

This belief is confirmed by the fact that during the winter vast swarms of these butterflies are seen congregating in the Southern States. Mr. R. Thaxter of Newtonville, Mass., gives, in a recent number of the *Canadian Entomologist*, an interesting account of their thus congregating in Apalachicola in Florida, in pine groves. He says :

"The trees were literally festooned with butterflies within an area of about an acre, and they were clustered so thickly that the trees seemed to be covered with dead leaves ; fig. 35 will enable the reader to form some idea of their appearance thus grouped. Upon shaking some of th- trees a cloud of butterflies flew off, and the flape

ping of their wings was distinctly audible. They hung in rows (often double) on the lower dead branches, and in bunches on the needles. I find by my note book that visiting the flock towards evening, it was receiving additions every moment. I caught a net full off a bunch of dead needles, and. walking away to some distance and letting them go, all but three returned to the flock. The question as to where they came from seems a very interesting one. I was told by Dr. A. W. Chapman that there was hardly milk-weed enough in all Florida to produce one of these flocks, which doubtless do not confine themselves to Apalachicola. During my visit I found two more flocks not far from the first, but neither of these was as large. I should mention that I often observed examples among them *in coitu*."

The inference is legitimate from facts like this that the pine forests of the more southern States offer the most favorable hibernating quarters for this butterfly, notwithstanding the milk-weeds are scarce throughout that country compared with what they are in the more northern States. Under the most favorable conditions there is little doubt that the larger proportion of

[Fig. 35.]

Clustering of DANAIS ARCHIPPUS (after Thaxter).

the individuals comprising such swarms perish before spring. The few pregnant females that survive may be seen, faded and often tattered, flying swiftly in the spring in a northward or northwestward direction over the prairie region of Texas, Indian Territory, Kansas, etc., supplying the milk-weeds here and there with eggs. A fresh generation is produced in less than a month, and these extend still further north, until we find the species late in summer away up in the Saskatchewan country. In an article in the *Scientific American* for April 6, 1878, in which these views were put forth, we concluded with the following paragraph :

"We can thus understand how there are two, three, or more broods in southerly regions, but only one toward British America. The exceptional flights noticed in the spring, and which, so far as recorded, take place quite early and in the same southerly direction, find a similar explanation. They may be looked upon as continuations of the autumn flights. Hibernating in the temperate belt, the butterflies are awakened and aroused upon the advent of spring, to find the milk-weeds not yet started, and they instinctively pass to more southern regions, where spring is more advanced. In short, these migrations find their readiest explanation in the instinct of the species to lengthen the breeding season and to extend its range ; and the prevailing winds at particular seasons are of a character to assist it. There is a southward migration late in the growing season in congregated masses, and a northward dispersion early in the season through isolated individuals. It is a notable fact that the two butterflies which most display this instinct, namely, the species in question and the 'Painted lady' (*Cynthia cardui*), have the widest range of known species. The last is cosmopolitan, occurring in all quarters of the globe ; while our Archippus, originally confined to America, though ranging from Canada to Bolivia, appears to be following the milk-weeds wherever these are, through chance or purpose, introduced. It has lately spread over some of the islands of the Pacific, to Queensland and New Guinea, and over the Azores to Europe, such a spread necessarily indicating great power of long-sustained flight, since the milk-weeds are not plants of commercial value, and it is highly improbable that the species has been carried in any of the preparatory states on ships."

What is true of the Archippus butterfly is largely true also of the large yellow butterfly, *Calidryas eubule*, which has a very wide range, and the larva of which feeds on different species of *Cassia*. Careful observers in the Southern States have insisted that this butterfly invariably moves to the south or southeast in the Fall of the year and just as invariably in the opposite direction in the spring. So marked is this in the case of *eubule* that day after day the insects may be seen flying by in a bee-line which they pursue so persistently that, rather than deviate to the right or left of a building or other intervening obstacle, they always pass over it though the flight is ordinarily quite low.

The regular meetings of the Cambridge Entomological Club for the next three months are fixed on April 9, May 14 and June 11. The Club meets at 19 Follen St., Cambridge, Mass., at 7.45 p. m.

FUNGUS DISEASES OF INSECTS.

Prof. Elias Metschnikoff gives, in the *Zoologischer Anzeiger*, No. 47, p. 44–47, a short abstract of his investigations on the fungus diseases of insects during the year 1878, together with some more recent observations on the practical application of parasitic fungi for the destruction of injurious species. The original contribution is in the Russian language, "On the diseases of the larva of the Grain-beetle." (Odessa, 1878.) This beetle is a Lamellicorn, (*Anisoplia austriaca*) which, with several allied species of the same genus, is most injurious to wheat and other grains in Southern Russia. Prof. M. found that the *Anisoplia*-larva which lives in the ground is subject to several diseases, one which he calls the "green muscardine," being produced by a parasitic fungus (*Isaria destructor*). The same fungus was also found to so greatly infest another beetle, *Cleonus punctiventris*, which is very injurious to beets, that in the month of August, when the disease had not yet disappeared, about 40 per cent. of the progeny of the beetle was destroyed. Of the experiments made to infest the *Anisoplia*-larvæ with the spores of the *Isaria* several were successful, but in some cases the larvæ remained healthy for a long time. The same experiments made to infest the *Cleonus*-larvæ were eminently successful. Of 90 larvæ which for a short time were brought in contact with the spores. 62 died from muscardine within 12 days. On the imago of the *Cleonus* the muscardine acts somewhat more slowly but just as surely. Of 58 beetles which he infected when fresh from the pupa, 52 died from muscardine within 15 days. From these and other experiments Prof. M. concludes that *Isaria destructor* produces an epizöotic disease on the insects mentioned, and believes it possible to produce this disease by sowing the spores. But in order to do this it becomes necessary to cultivate a quantity of the spores. This was easily done by burying insects that had died from muscardine in wet sand and keeping them there for a few weeks, when a rich mycelium was found to be developed. It proved much more difficult to cultivate the spores in organic fluid, but finally it was found that when beer mash is kept boiling for some time, and, when cooled, spores are sown on the fluid, a rich mycelium is developed on the surface as well as within the fluid. "The data here given," Prof. M. concludes, "are based upon the principles of the more recent mycology, especially on the classic works of deBary on insecticide fungi, while Hagen relies for his proposed method on the older ideas of Bail, according to whom the parasitic fungi are in genetic relationship with the yeast-fungus, moulds and *Saprolegniæ*. It is on this last supposition that Prof. Hagen thinks it possible that the yeast-fungus when applied to insects can penetrate within the body, live there parasitically as *Empusa*, and finally cause the death of the host. So long, however, as the scientific basis of this theory is not more firmly established, a practical application of the same is simply out of the question."

There are over 200,000 species of insects in this country, many of them useful as parasites and many injurious. Many injurious insects can be held in check by a concert of action. The curculio has been whipped and the coddling moth has been held in check by a concert of action. If the executive committee of our society would offer a premium of $50 or $100 to that township or neighborhood that will bandage and perfectly protect the trees in the largest area, it will be a great credit to the society, and will be the means of doing great good, and as Entomologist of the society I recommend it.—Prof. A. J. Cook, before the Michigan Pomological Society.

Messrs. List & Franke, booksellers, Leipzig, Germany, offer for sale the rich entomological library of the eminent dipterist, Prof. Loew, who died a year ago.

Among European entomologists few were better known in this country than Dr. Jean-Baptiste Alphonse Dechauffour de Boisduval, who died last December, in his seventy-ninth year.

In the report of the U. S. Entomological Commission concerning their efforts to discover a method for destroying the worm or caterpillar which is so destructive of growing cotton plants, there is high credit given to a product which is now being developed by enterprising Californians in the San Joaquin valley. We refer to the California-grown Dalmatian insect powder, or "Buhach," as it is styled by Mr. Milco, of Stockton, who brought the plant from his native country. * * *

This report of Prof. Riley will doubtless aid in developing the enterprise which Messrs. Milco, Peters and Paulsell now have in hand, and we trust it may be fully successful and profitable to its projectors. It bids fair ere long to shut off the importation of foreign insect powders, and this will gain for it the sympathy of all lovers of home industry.—*Pacific Rural Press.*

Regular meetings of the Entomological Section of the Boston Society of Natural History are announced for April 28 and May 26.

ON THE TRANSMISSION OF INSECTS THROUGH THE U. S. MAILS.—Entomologists have suffered much annoyance and loss through the action of postmasters who have refused to allow insects to pass through the mails. A very vexatious circumstance of this kind which occurred recently, determined me to ascertain what the laws were respecting this matter; and, if necessary, to urge that some change be made so that specimens of insects could be transmitted in this manner, provided they were so packed that no injury could result to other mail matter, or to the person of any one engaged in the postal service. The result of a subsequent study of the postal laws and of an interview with the Postmaster-General may be of interest to those readers of the AMERICAN ENTOMOLOGIST who, like the writer, have submitted to having highly prized property destroyed by postmasters.

There is nothing whatever in the postal laws that declares dead insects unmailable. Section 222 of the Postal Laws and Regulations, ed. 1879, expressly states that it is live insects that are unmailable. Neither is there any reason why pinned specimens should not be mailable. Section 223 [L.C.], which prescribes how sharp-pointed instruments are to be secured so as not to injure the mails, indicates a mode of packing almost identical with that commonly practiced by entomologists. Hence there is no reason why entomological specimens should be excluded from the mails, provided they are securely packed and are not alive.

As to living specimens, the Post Office authorities are unwilling to change the law so as to admit them to the mails as "fourth-class matter," fearing that such a change would result in the admission of very objectionable creatures. It therefore only remains for those who desire to send living insects by mail to seal the package containing them, and to pay postage upon it at letter rates. The following law protects such packages:

"Sec. 434 [L. C.]. *First-class matter not to be held unmailable on mere suspicion.*—Postmasters are specially warned that they have no right to detain first-class matter upon the mere suspicion that it contains articles forbidden to be sent in the mails. Neither will they, under any circumstances, be justified in breaking the seal of any letter or package to ascertain whether or not unmailable matter is inclosed."

—J. H C., Washington, D. C.

The Cambridge Entomological Club at its recent annual meeting re-elected Mr. Burgess as President; Mr. B. Pickman Mann Secretary, Treasurer and Editor of *Psyche.* The Club consists now of 16 resident and 56 non-resident members.

Bran seems to be a popular remedy just now in England for slugs, which are said to be fond of it, being attracted from all directions to it. It is placed among the plants in the evening, on pieces of slate, and these traps subsequently emptied with the slugs into a vessel of salt and water

The Entomological Section of the Academy of Natural Sciences of Philadelphia will hold regular meetings on April 9th, May 14th and June 11th, in the building of the Academy.

ON OUR TABLE.

Practical Floriculture; a Guide to the successful cultivation of Florists' Plants, for the Amateur and Professional Florist. By Peter Henderson. Third edition. Greatly enlarged. 12mo. pp. 311. 72 illustrations. New York, 1879. Orange Judd Co. This third edition of an inestimably useful work has grown out of "hundreds of questions which have suggested themselves to those already in possession of the first and second editions." It is replete with information of value, especially to the novice and the amateur; and no flower lover who owns a garden, or a window-garden, should be without it.

The Chinch-bug; its history, characters and habits, and the means of destroying it or counteracting its injuries. Bulletin No. 5, U. S. Entomological Commision. By Cyrus Thomas, Ph. D. This is an exhaustive account of an insect which, taken all in all, is perhaps the most serious pest which the grain-grower has to contend with. While giving accurate information as to the insect's habits, natural history and enemies, it is, like the other publications of the Commission, chiefly devoted to the practical question of how to control the enemy. Written for the farmer, with all necessary illustrations, its wide circulation can not fail to be productive of good.

The Entomological Libraries of the United States. By Samuel Hubbard Scudder. 8vo. pp. 6. (Republished from Bull. of Library of Harvard University.) Cambridge, Mass., 1880. From the Author.

Some of the Insects that frequent the Orchard and Garden. By Rev. T. W. Fyles. 8vo. pp. 13. Illustrated. (Reprinted from 4th Rep. of the Montreal Hort. Soc.) Montreal, 1879. From the Author.

The Food of Birds. (The Thrush Family.) By S. A. Forbes. 8vo. pp. 58. (From Trans. Ill. State Hort. Soc. Vol. XIII. 1879.) From the Author.

An Historical Sketch of Henry's Contribution to the Electro-magnetic Telegraph, with an Account of the Origin and Development of Prof. Morse's Invention. By William B. Taylor. 8vo. pp. 103. (From the Smithsonian Report for 1878.) Washington, 1879. From the Author.

Étude sur les Espèces de la Tribu des Féronides qui se rencontrent en Belgique. Par A. P. de Borre. 8vo. pp. 46. (Ext. des Annales de la Société Ent. de Belgique.) Nov. 1878. From the Author.

Quelque conseils aux Chasseurs d'Insectes. Par A. Preudhomme de Borre. 8vo. pp. 7. (Ext. des Comptes-rendus de la Soc. Ent. de Belgique. Séance du 2 Novembre, 1878.) From the Author.

Sur l'œuf et la jeune larve d'une espèce de *Cyphocrania*. Par A. Preudhomme de Borre. 8vo. pp. 2. (Ext. des Comptes-rendus de la Soc. Ent. de Belgique. Séance du 2 Novembre, 1878.) From the Author.

Note sur des Difformités observées chez l'*Abax ovalis* et le *Geotrupes sylvaticus*. Par A. P. de Borre. 8vo. pp. 3. (Extr. des Comptes-rendus de la Soc. Ent. de Belgique. Séance du 7 Decembre, 1878.) From the Author.

Annual Report of the North Carolina Agricultural Experiment Station, for 1879. By Albert R. Ledoux, A. M., Ph. D. 8vo. pp. 198. Raleigh, N. C., 1879. From the Author.

Description of some minute Hymenopterous Insects. By J. O. Westwood, M. A., F. L. S., etc. 4to. pp. 11. 1 plate. (Ext. from Trans. Linnean Soc. of London. Second series. Zoology, Vol. I.) London, Eng., 1878. From the Author.

Observations on the Uraniidæ, a Family of Lepidopterous Insects, with a Synopsis of the Family and a Monograph of Coronidia, one of the Genera of which it is composed. By J. O. Westwood, M. A., F. L. S., etc. 4to. pp. 36. 4 plates. (Ext. from Trans. Zool. Soc. Vol. X. Part XII.) London, Eng., 1879. From the Author.

A Decade of new Cetoniidæ. By J. O. Westwood, M. A., F. L. S., etc. 8vo. pp. 10. 2 plates. (Ext. from Trans. Ent. Soc., 1879. Part II.) London, Eng. From the Author.

Report of E. W. Hilgard, Professor of Agriculture, University of California. (Supplement to the Biennial Report of the Board of Regents.) 8vo. pp. 113. Sacramento, Cal., 1879. From the Author.

Leeds & Co.'s Plant Catalogue for Spring of 1880. 8vo. pp. 56. Richmond, Ind. From Leeds & Co.

Sopra Certi Organi di Senso nelle Antenne dei Ditteri. Memoria del Dott. Paolo Mayer. 4to. pp. 12. pl. 1. (Reale Accademia dei Lincei. Anno 1878-9.) Roma, 1879. From the Author.

Report of the Curator of the Southern Illinois Normal University, G. H. French. 8vo. pp. 18. (Ext. from the Fifth Annual Report of the Principal to the Board of Trustees.) Carbondale, Ill., 1879. From the Author.

Ein sechstes Phytoptocecidium von Acer campestre. Von Dr. Fr. Thomas. 8vo. pp. 6. (Abdruck aus der Zeitschrift für die gesammten Naturwissenschaften Band. LII. 1879. September-October-Heft.) From the Author.

De la Meilleure Disposition à donner aux Caisses et Cartons des Collections d'Insectes. Par A. P. de Borre. 8vo. pp. 4. (Ext. des Annales de la Soc. Ent. de Belgique. Séance du 5 Avril, 1879.) From the Author.

Notice sur les Espèces des Tribus des Panagéides, des Loricérides, des Licinides, des Chlænides et des Broscides, qui se rencontrent en Belgique. Par A. Preudhomme de Borre. 8vo. pp. 27. (Ext. des Comptes-rendus de la Soc. Ent. de Belgique. Séance du 1 Juin, 1878.) From the Author.

Production and Distribution of Cereals of the United States. By J. R. Dodge. 8vo. pp. 14. (Ext. from Report of Joseph Nimmo, jr., chief of the Bureau of Statistics on the Internal Commerce of the United States.) Washington, Dec. 1, 1879. From the Author.

Bulletin de la Société Entomologique Suisse. Vol. V, No. 9. Schaffhausen, Dec. 1879. From the Editor.

Le Phylloxera. Comités d'études et de vigilance. Rapports et Documents. 11e Fascicule. Paris, Oct. 1879. From the Editor.

Report of the Board of Trustees of the Maryland Agricultural College. 8vo. pp. 20. Annapolis, 1880. From A. Grabowskii.

EXTRACTS FROM CORRESPONDENCE.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

Pyrethrum for House Plants.—I have tried the Pyrethrum powder to some extent, and find it a perfect remedy for the green *Aphis* on house plants. We have dusted our plants only twice this winter and there is not an *Aphis* nor a scale, nor a Mealy-bug to be seen, either in the house or in the pit. Our plants never were so thrifty and beautiful. We have, however, had an exceptionally mild and sunny winter.—Mary E. Murtfeldt.

Green varieties in the genus Argynnis.—I have been very much interested in Edwards's Butterflies of North America, especially with reference to the fact that three species of the genus *Argynnis* there figured have always green females. Now in the New Forest, I find that a fair percentage of females of *Argynnis paphia* are green, and it appears to me that in this wild district we have an archaic coloration of this species; for I am told that rarely, if ever, in other parts of England is such a variety seen. I took twenty-two specimens of this variety in August last, after great labor, as the Forest was a complete bog, owing to our wet season.—J. Jenner Weir, London, Eng.

Influence of Winds on Aletia.—I discover your leaning towards the theory that, in this latitude the Aletia hibernates, and that the advent of it on the summer's cotton growth is from the hibernated moth of the vicinage.

I have heretofore expressed both to yourself and to Prof. Comstock the result of my observa-

tions, to the effect that a dry season, that is, one not too wet for cotton, may be followed by the caterpillar, in this latitude, in such numbers as to do great injury to the crop; and that a wet season, that is, one in which the rain-fall lessens the maturity of the fruit, may not be followed by the caterpillar in sufficient numbers to injure the crop.

I desire to direct afresh your observation to the *influence of the winds* on the Aletia. For some years past this has been my own observation on that subject, viz.:

(1) At *any season of the year* the prevalence of S. East winds for two or three days consecutively, regardless of *wet* or *dry* weather, will be followed in fifteen to twenty days after the prevalence stated of those winds, by the moth of the Aletia in large numbers.

(2) If the winds prevail from any other course than E. and S. of East, after May and until October, we do not, in this latitude, find the caterpillar in numbers sufficient to injure the crop of cotton.

(3) Last year (1879) I made note of the following facts: the month of May was dry in this vicinity; so dry that corn was retarded in growth, and everywhere unpromising; *E. and S. East winds prevailed; ergo* (?) early in June the cotton caterpillar was reported in large numbers in Montgomery and Dallas counties!

(4) Early in June the winds changed their course from E. and S. E. to S. and S. West. The caterpillars present did no harm whatever, for full three months.

Now, let us note the seasons from June to 10th Sept., when at this latter date the caterpillars began to destroy the crops.

The season from June to 15th July was dry, and the winds were S. and S. West.

A rainy season began on 15th July. We had daily rains until 19th August. The winds continued to come from S. and S. West all the rainy season. The caterpillars did *no harm* in this rainy season, although they were alarmingly present.

The rain ceased 6 days to begin again on 25th August.

The winds veered on 25th Aug. or about that day, from S. and S. West to E. and S. East, and by 10th Sept. all *the foliage had been* stripped from the cotton!

The summary of these facts is that (1) early in June after a dry May, distinguished by the prevalence of E. and S. East winds, the caterpillar appeared; (2) the caterpillar did not then eat the crop, and contemporaneously with its advent the winds changed from E. and S. E. to S. and S. West; (3) a rainy season put in 15th July and was excessive until 19th August, and the winds were S. and S. West, and the caterpillar though present did no work; (4) the rains began again 25th Aug. and the winds were then, for *the first time since May, E. and S. East*, and by 10th Sept. the caterpillar had destroyed the crop.

There were two seasons of E. and S. East winds *only*, one in May followed by the caterpillar, another from 25th Aug. to 10th Sept. followed by the caterpillar.

The caterpillar was present from June until 25th August but did no work, and in that time the winds were S. and S. West.

What effect has the course of the winds on the character of the growth of the cotton plant? and what character of growth in the cotton plant is favorable or unfavorable to the sustenance of the caterpillar?

My observation is, the prevalence of E. and S. E. winds is followed by a rich, juicy, sappy, heavy foliage, never that which precedes a heavy *fruitage* of *blooms and bolls*; and that the prevalence of S. and S. W. winds is followed by small, pale-green, sharp-pointed foliage, favorable to heavy fruitage of blooms and bolls.

I have also noted that the caterpillar destroys the rich foliage much more greedily than he does the hard pale-green foliage.

It is a common remark that a "worm year is never a cotton year, even if the worm did not destroy the crop."

I never saw a good yield of blooms and bolls with the winds from E. and S. East.—J. W. DuBose, Pike Road, Montgomery Co., Ala.

Mite preying on Orange scale.—In *Canadian Entomologist* No. 8, Vol. XI, I described a mite under the name *Acarus gloverii*, and thought it probably preyed upon the eggs of a scale insect.

This winter I have continued my investigations and have had the pleasure of studying up its life history.

The mite belongs to the genus *Tyroglyphus*.

The eggs, between two and three hundred, are laid in December on the under part of an orange leaf, generally close to a midrib or a primary vein, and frequently alongside a scale.

They are elliptical, of a reddish-yellow color, nearly twice as long as broad, and very finely granulated. Length about 1-500 of an inch.

From the middle of January until the middle of March, there hatches a six-legged mite, of a bright blood-red, with three or four oval black spots on hinder part of abdomen, and sparsely covered with long hairs, six of these (two anterior, two posterior, and two lateral) are much longer than the others.

In from three to four weeks these curl up their legs and form a sort of pupa, which in a few days changes into an eight-legged mite, having nearly the shape as before, only larger, broader and more flattened, with two short hairs protruding from the head and of a lighter shade of red. In these stages they are gregarious, all living hud-

dled together close to midrib. The eight-legged mite again changes its skin and becomes the active little mite described in *Canadian Entomologist.*

Scales, on the same leaf with these mites, are always empty, proving that they are beneficial to the orange grower.—Wm. H. Ashmead, Jacksonville, Fla.

Habits of Gall-making Plant-lice.—The most astonishing feature of my recent observations on "*Pemphigus bursarius*" is, that the first "pupifera" come back to the tree before even the last "emigrants" have left it, and, as the first ones bearing the sexuated young enter in the old galls just left by the emigrants, it looks as if some of the "emigrants" instead of leaving the tree remained in it.—J. Lichtenstein, Montpellier, France.

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Gouty Gall on Blackberry and Raspberry Canes.—A friend has referred me to you for the name (common and scientific) of the insect which stings blackberry canes and causes them to swell and die. If an account of the habits, etc. of this insect is published in any of your Reports, please tell me how or on what terms I can get the number desired.—P. S., Vineland, N. J.

We are troubled with an insect that bids fair to destroy our canes both of Blackberry and Raspberry more especially on the "Early Wilson" Blackberry and the Red varieties of the Raspberry. The insects deposit their eggs from six inches to a foot above the ground, and the first indication of their work is an enlargement of the cane; they usually select the largest canes, and they remain over the winter above the enlargement, where they can be found very readily at this time. I would like to know if there is a practical remedy? I have been watching their work for a number of years and find they are on the increase. I would like to know how soon the insect's work can be *detected* and how long are they depositing their eggs?—T. A. C., Anna, Ill.

One of our principal revenues here is derived from raising blackberries; within a few years, swells have appeared on the canes; and are increasing from year to year, threatening to either destroy the business, or make it very unprofitable. We are alarmed for our safety and have appointed a committee (of which I am one) to investigate the cause, and if possible to find a remedy; I appeal to you, hoping you will be so kind as to give us the necessary information by which we can save a crop upon which we so much depend. Many of the swells this year are below ground.—J. W., Vineland, N. J.

All three of the above inquiries refer to the same insect (*Agrilus ruficollis*), treated of and illustrated in another part of this number. The larva retires into the pith to transform in April and May, and the canes should therefore be cut and burned before the month of April. The beetles should be looked for in June and July when the females are laying their eggs, and are easily seen and captured.

Sowing Cotton Seeds in hot-beds and transplanting as a means of preventing injury from the Cotton Worm.—*Wm. J. W., Fort Magaia, Youngstown, N. Y.*—The suggestion which you make of planting cotton seeds in hot beds during the winter and transplanting the plants thus raised when spring opens, in order to gain time and produce a crop before the Cotton Worm appears, occurred to us two years ago on our first visit to the South, but, upon suggesting it and urging it to experienced planters, they invariably replied that the cotton plant forms such a long tap-root and is so very sensitive to removal or transplanting, that it will be impracticable to do as we do in the more northern States with young sweet-potato plants. The only way in which cotton plants could be successfully transplanted would be from small pots, and such mode is precluded on account of the expense, though paper bags, it seems to us, might in many instances be successfully used for this purpose.

Not the Cotton Moth.—*D. B. Woodbury, Paris, Oxford Co., Me.*—The moth which you send is not the Cotton Moth, but something quite distinct, known to entomologists as *Tolype velleda.* Its larva feeds on Apple and sundry other trees.

Moths caught in Alabama; Muscle-shaped Bark-louse on Apple trees South—*J. F. Bailey, Marion, Ala.*—Your specimens were duly received. Of the moths it would be useless to give you the names, as they were not numbered; none of them, however, were Aletia, but there were specimens of the common Northern Army Worm and of one of the commonest Cut-worm moths (*Agrotis ypsilon*). The large black butterfly is *Papilio philenor*, the larva of which feeds on *Aristolochia.* You are right in the determination of *Pieris rapæ.* The large bee which is robbing the honey bees of their scanty stores is *Bombus virginicus* ♀. The mussel-shaped scales on apple-twigs from the orchard of Mr. E. A. Heard are the dreaded mussel-shaped bark-louse of the Apple (*Mytilaspis pomicorticis* Riley). We have

not before received them from so far south, and would recommend Mr. Heard to get rid of the trees that are already dead, severely prune the rest, burn the prunings and then apply flax-seed oil or brush the trunk and twigs over rapidly and lightly with kerosene. If carefully done this will not injure the trees materially and will be sure death to the scale-insects.

The Cedar Beetle.—I send you two specimens of an insect that is very abundant here upon the Arbor-vitae and Red Cedar trees, eating the bark from the small branches and twigs. This insect has already destroyed a large number of the above named trees in this part of the country, and still continues its ravages. Please tell me what you know about this pest.—P. B. Fuisen, La Grange, Tex.

The small beetle, about one-tenth of an inch long, with dark brown, rough wing-cases, is an old and well known pest of various kinds of evergreen trees. It is the *Hylurgus dentatus* Say, or, according to a recent revision of the *Scolytidæ* of the United States by Dr. J. LeConte, *Phlœosinus dentatus* Say. It belongs to a very destructive family of insects, as the *Scolytidæ* are mainly bark-beetles and wood-borers, and instances are recorded where they have destroyed extensive forests in a few years. The Toothed Hylurgus, or Cedar-bark beetle, has long been known to attack the Red Cedar (*Juniperus virginiana*) and the Arbor-vitae (*Thuja occidentalis*), and it no doubt infests other closely allied species of the Coniferæ. Harris states "that the female bores a cylindrical passage beneath the bark of the Cedar, dropping her eggs at short intervals as she goes along, and dies at the end of her burrow when all her eggs are laid. The grubs hatched from these proceed in feeding nearly at right angles, forming on each side numerous parallel furrows, smaller than the central tube of the female. They complete their transformations in October, and eat their way through the bark, which will then be seen to be perforated with thousands of little round holes, through which the beetles escape." The description of the habits of this insect as given by Dr. Harris is applicable to several other species of Scolytus, and it is just possible that the one he describes is not the *P. dentatus*; besides he says nothing of the beetles feeding on the bark, which the one under consideration evidently does, to the great injury of the trees it infests. We hope you will make further observations as to the habits of this insect, and remove the bark from infested trees, both dead and dying, and see to what extent they bore under the bark; also note the form and extent of their excavations.—A. S. F.

Chrysalides supposed to be those of Aletia.—I inclose in a small tin box, accompanying this letter, some cocoons ploughed up to-day in my cotton field *here* where there were Cotton worms last year, which resemble the plexus of that insect. They are somewhat bleached by remaining under ground so long. This may be considered a fair test, if they should come out of their cover. If none of them bring forth the Cotton miller then they are not perpetuated in that form. I gathered these myself by following the plow a few rounds. Please acquaint me with the result.—William J. Jones, Virginia Point, Tex.

The chrysalides sent by our correspondent are not those of Aletia but belong to other species of night-flying moths, one the parent of a common Cut-worm (*Agrotis inermis*), the other *Prodenia lineatella* Harvey, the parent of a worm that is quite commonly found in cotton fields.

Apple-twig borer.—*T. V. M., Denison, Tex.*—The beetles you send, boring during the month of February in the twigs of your apple trees, are the common Apple-twig borer (*Amphicerus bicaudatus*) of which you will find an account, with figures, on pp. 50–51. The reasons why you failed to find the larvæ of this beetle in the twigs are also given there.

Clover-weevil.—*W. W. F., Waterville, Ohio.*—The weevil you refer to in your letter of Feb. 16, which does considerable damage to clover in the eastern part of your State, by workin in the seed and reducing it to a mere shell, cannot be the Clover Root-borer (*Hylesinus trifolii*) of which we gave an account in our Report to the Department of Agriculture, because this latter confines its work to the roots and to the stem immediately above the ground. Without seeing specimens it is impossible for us to say anything definite about your species, as there are several "weevils" known to infest clover seeds. We shall be glad to receive specimens.

Beetles from Northwest Territory.—*John D. Evans, Belleville, Ontario.*—The Coleoptera from Great Northwest Ter., near Manitoba, are No. 1, *Cicindela montana* Lec. No. 3, *Cic purpurea*, var. *Auduboni* Lec. No. 4, *Cic purpurea*, green variety. No. 7, *Cic lepida* Dej. No. 12, *Calosoma obsoletum* Say. No. 16, *Carabus tædatus* Fabr. No. 18, *Calosoma moniliatum* Lec. No. 20, *Platynus micans* Mén. No. 22, *Platynus molestus* Lec. No. 37, *Amara jacobinæ* Lec. No. 49, *Amara fallax* Lec. No. 54, *Amara terrestris* Lec. No. 65, *Bembidium impressum* Fabr. No. 216, *Asida polita* Say. No. 215, *Eleodes opaca* Say. No. 217, *Eleodes obsoleta* Say. No. 211, *Eleodes hirtilabris* Say. No. 214, *Eleodes extricata* Say. No. 213, *Eleodes tricostata* Say, No. 101, *Quedius fulgidus* Fabr. No. 118, *Coccinella 5-notata* Kirby. No. 132, *Aphodius occidentalis* Horn. No. 136, *Dichelonycha Backii* Kirby. No. 150, *Corymbites morulus* Lec. No. 160, *Photinus borealis* Rand. No. 162, *Photinus nigricans* Say. No. 196, *Disonycha collaris* Fabr. No. 182, *Chrysomela multipunctata* Say. No. 203, *Graptodera* —. No. 230 *Cantharis Nutalli* Say.—A. S. F.

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THE INSECT ENEMIES AND DISEASES OF OUR SMALL FRUITS.

[Read before the New Jersey State Horticultural Society, Jan. 16, 1880, by A. S. FULLER.]

[*Concluded from p.* 93.]

The Strawberry.

Among the insect enemies of the Strawberry, the common White Grub is probably one of the most destructive. It is the larva of the May-beetle, June-bug, or Dor-

[Fig. 36.]

STRAWBERRY WORM:—1, Ventral view of pupa; 2, side view of same; 3, enlarged sketch of perfect fly, the wings on one side detached; 4, larva crawling, natural size; 5, perfect fly, natural size; 6, larva at rest; 7, cocoon; 8, enlarged antenna, showing joints; 9, enlarged egg (after Riley).

bug—being known by all these names in different parts of the country. There are over fifty distinct species of May-beetles found in this country north of Mexico, but the one here referred to is our most common brown May-beetle, the *Lachnosterna fusca* of Fröhlich. These beetles frequent meadows, pastures and uncultivated fields, for the purpose of depositing their eggs in places where their young will be sure of plenty of food, and not likely to be disturbed. The young grubs as soon as hatched commence feeding upon the roots of various plants, those of the Strawberry and different kinds of grasses being preferred to the weeds. These grubs live three years before passing through the pupa state and coming forth as beetles. During these three years of constant work upon the roots of plants they may do much damage to whatever kind they may attack. Their injury to Strawberry plantations results mainly from bad management and the failure of the grower to use preventive measures. Good old pasture and meadow lands are frequently selected for Strawberry plantations, and sod is turned over, and as soon as sufficiently rotted, the plants are set out. In the mean time the grubs that were already in the ground, and perhaps of various ages from a few weeks to a year or two, have been fasting, or making an occasional meal of the half-decayed grass roots. Finding fresh Strawberry roots thrust before them, they commence a most vigorous attack upon such tender food. The planter is astonished to see his Strawberries disappear, and wonders where all the grubs could have come from in so short a time.

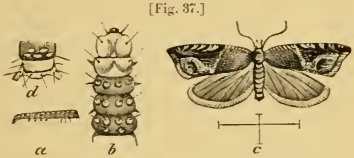
Now in regions where the White Grub abounds it is not safe to set out Strawberries on freshly inverted sod; but the land should be cultivated at least two seasons in some crop requiring frequent hoeing and plowing, before using it for this purpose. Neither should the Strawberry plantation

remain or be continued on the same piece of land for more than two or three years, if what is called the matted or bed system of cultivation is pursued; because the parent beetle soon learns that these weedy, little-disturbed plantations, are a safe place for her to deposit her eggs.

To avoid injury to Strawberry plantations by this insect, use land that has been occupied at least two years in some hoed crop, like corn, potatoes, or beans, and then set out a new one on fresh land as soon as the old plants begin to fail.

As all the May-beetles are nocturnal in habit many may be taken by using tubs of water with a floating light in the center.

[Fig. 37.]



STRAWBERRY LEAF-ROLLER:—*a*, larva, natural size; *b*, head and thoracic joints; *d*, anal joint of same; *c*, moth—enlarged (after Riley).

A few hundred taken every evening during the first few weeks of summer will do something toward diminishing the number of the succeeding generations in a neighborhood, but the birds and domestic fowls are the Strawberry grower's most efficient helpers in the way of destroying May-beetles and White Grubs.

Among the various other kinds of insects injurious to the Strawberry there is perhaps none more destructive than that known as the "Strawberry Worm." This pest is a small, slender, pale-green worm that attacks the leaves, eating large holes in them. When at all abundant it soon destroys the entire foliage, and of course prevents further growth of the plants. A few years ago this pest almost ruined the plants in my garden, but of late it has not been very abundant, although it has not entirely disappeared. This Strawberry Worm is the larva of a small black fly (*Emphytus maculatus* Norton, Fig. 36, 3). Dusting the leaves with lime would probably check the increase of this insect. There is also another worm that attacks the leaves of the Strawberry, but this is a leaf-roller and the caterpillar of a small, handsome moth (*Anchylopera fragariæ* Walsh and Riley, Fig. 37). I have not observed it in my grounds, but it is quite abundant in the Western states, also in Canada, where it is occasionally very destructive. In addition to the above there is a small snout-beetle known as the Strawberry Crown-borer (*Tyloderma fragariæ*, Riley, Fig. 38), that works in the crowns of the plants, destroying the embryo fruit stalks and leaves. The remedy proposed is to plow up the Strawberry plantations soon after gathering the fruit in summer, and while the little grubs are still in the crown of the plants.

[Fig. 38.]

STRAWBERRY CROWN-BORER:—*a*, larva; *b*, beetle, side view; *c*, do. dorsal view—enlarged (after Riley).

Several other species of noxious insects might be added to the above list of those injuring the small fruits, but I think enough have already been named to show that the berry growers do not find the business quite so profitable or free from annoyances as many persons seem to imagine.

EFFECTS OF COLD APPLIED TO THE CHRYSALIDES OF BUTTERFLIES.

Mr. Wm. H. Edwards of Coalburgh, W. Va., has recently given in *Psyche* a detailed account of a series of experiments, made with a view of ascertaining the effects of artificial cold brought to bear on the chrysalides of butterflies. The effects of hibernation in the chrysalis state as exemplified in the vernal forms of double-brooded or many-brooded species is toward reduction in size and albinism or loss of color. We proved this by actually breeding the *vernalis* form of *Pieris protodice*, from eggs laid by the typical summer form of this last, and have been often struck with the

same fact in comparing butterflies from those parts of British North America, where the species may be presumed to be monogoneutic, with the same species from Missouri, where it is digoneutic. This generalization does not apply to species that hibernate in the imago state, though even here the lower mean temperature of the sub-boreal zone lessens the average size and renders the colors less strong. This is not noticeable with species like *Danais archippus*, which, we believe, annually migrate to such sub-boreal regions from more southern points. Mr. Edwards's experiments indicate that artificial cold on the chrysalis produces in the resulting imago the same effect that cold does in nature. We quote his general conclusions :

1. *Papilio ajax*. The longer the exposure under a low temperature the more decided the change, but 25 or 30 days seem quite sufficient in many cases, and changes have been produced by exposure for 20, 16 and 11 days ; no changes recorded at less than 11 days ; while exposure at 8 days and less has produced no effect in some cases to prolong the chrysalis period.

2. The longest interval between pupation and exposure to cold when any change has resulted, has been 3 days. In all instances beyond that no change has been produced. The shortest interval has been two hours, and in this instance the butterfly was changed to *walshii*, which is a change more extreme than to *telamonides*. Most chrysalids exposed so early die in the process, but as many changes have been effected when the age of the chrysalis at exposure has been from 12 to 24 hours, I believe that to be the most satisfactory period. The chrysalis has then become hardened, and the growth of the organs of the pupa probably then begins, and their direction may best be turned by the cold then applied.

3. The effect of the cold is to albinize the butterfly, the black area being constantly reduced.

4. Cold has failed to change the shape of the wings, its influence being confined to coloration and markings ; the frontal hairs of the head have also been changed ; and the sexes are equally susceptible.

5. *Grapta interrogationis*. 14 days' exposure after the chrysalids have hardened, has been found sufficient to produce changes ; and the females were most susceptible to the influence of cold.

6. With different species the degree of temperature required to produce the most decided change varies. I have succeeded best with *Phyciodes tharos*, at 40° F. [4.4° C.]. At 32° F. [0° C.] have destroyed many *Grapta* chrysalids, but this may have been principally because the chrysalis was too tender when exposed. With *P. ajax* 32° to 40° F. [0° to 4.4° C.] seems a proper temperature.

My experiments with *Ph. tharos* are given in Can. Entom., v. IX, p. 4, and p. 204–206. Also in Butterflies of N. A., v. II, pt. 7. In the former, a complete change was brought about, and every butterfly emerged in the winter form. Temperature about 40° F. [4.4° C.], and continued for 7 days, the chrysalids being 3, 6, 9 hours old when exposed, and before several had hardened. In the second experiment the temperature was about 32° F. [0° C.] ; the chrysalids were 10 minutes to 9 hours old, and the exposure was about 20 days. It was found that the butterflies emerging from chrysalids which had been from 1 to 9 hours old were completely changed ; some which had been from 30 to 60 minutes old were not changed, while others of same lot were greatly suffused. I concluded that with this species it was not necessary that cold should be applied after the chrysalids had hardened, in order to change the form.

THE ROMANCE OF A CATERPILLAR.*

BY WM. C. WYCKOFF.

Of the insect tribes the most directly useful to man have been the producers of honey, silk and cochineal. The importance of the Bee to the ancients will be realized when we consider that they had to rely on honey alone for the means of sweetening food. Plato and Sophocles were honored by being called respectively the "Athenian Bee" and the "Attic Bee," in allusion to the dulcet style of their writings. The great attraction of the land which the Children of Israel struggled so hard to attain, was due to its reputation of flowing with milk and honey. In the paradise imagined by Lucian, honey spouted from some of the fountains. Sugar was then little known, except as one of the rare and curious things from the far East, and Strabo probably refers to it in a description of certain stones that had the color of frankincense, and a sweetness greater than that of figs or honey ; they were obtained in India. Pliny is more precise ; he says, "Arabia produces sugar, but that of India is preferable. It is a kind of honey, collected within reeds—a gum, almost white, brittle to the teeth, the largest (pieces) of the size of a hazel-nut, used only in medicine." Let us imagine for a moment that sugar should become equally rare at the present time. Would not the sweetness of life seem to have departed ? In the region beyond the Ister, according to the story told to Herodotus, the land was so completely possessed by bees that travel was

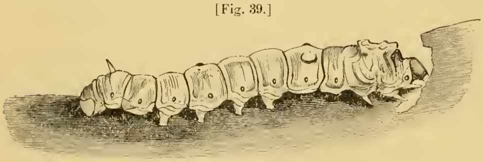
* Read before the Linnean Society of New York, January 24th, 1880.

impeded. But even if favored with such a source of supply, we would find the Thracian honey a poor substitute for the $80,000,000 worth of sugar now annually imported into the United States.

The dye furnished by the cochineal insects has also had and passed its day of high importance. The splendor of the Tyrian purple lives only in tradition, but we may fairly doubt whether it surpassed the best cochineal in richness of tint. The dark ages sadly needed bright colors. Few of the gifts of the Western continent have been of more service to mankind than the scarlet and crimson juices of the *coccus;* but now, its brightest tints seem pale beside the sunset glow of the aniline colors.

The Silkworm still retains its original importance, and is at present the most valuable of all insects to mankind. While no substitute for silk has been discovered, and perhaps none will ever be, a prophecy to that effect would not be quite safe. For instance: the limit of change in the properties of glass may not have been reached in the new processes of hardening it; suppose we could vulcanize it, as we do India-rubber; how long would it be before spun glass would be wound upon bobbins and woven in looms?

[Fig. 39.]



MULBERRY SILKWORM: full grown worm (after Riley).

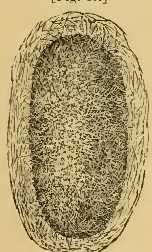
Whatever rival it may have to meet in the future, silk has at least an unbroken record of favor throughout the whole recorded history of civilization. Everywhere it is associated with ideas of opulence and luxury. Its bright threads are interwoven with and gleam out through the romances of every age. The discovery of the uses of silk must have been made at a very remote period, at least as far back as the era of the Mediterranean mythologies. The Egyptians attributed the invention to Isis, the Greeks to Minerva, the Lydians to Arachne. The ladies last-named had an unhappy quarrel. Arachne was the daughter of a dyer, and hence had a good introduction to the textile arts early in life. Especially was she skilled in embroidery, and she challenged the goddess of wisdom to a match with the needle. Each competitor prepared a show-piece of her handiwork. The fabric made by Arachne was certainly very elaborate, for it depicted all the noted love-scrapes of Jupiter. It is said to have been a really admirable piece of workmanship, but of course that of the goddess was pronounced the better. Poor Arachne committed suicide, and Minerva changed her into a spider, so that she might always be pulling threads and weaving webs for herself.

It is generally conceded that the use of silk began in China. Modern and ancient opinions on this point coincide. The following extracts give Pliny's notions; they are in Holland's quaint translation: "The first people of any knowledge and acquaintance be the Seres, famous for the fine silke that their woods doe yield." * * * * "It is commonly said that in the island of Coos there be certain silkeworms engendered of flowers, which by the meanes of raine-showers are beaten down and fall from the cypres tree, terebinth, oke and ashe; and they soon after doe quicken and take life by the vapor arising out of the earthe." Nearly all the allusions to silk in Greek and Roman literature show a belief that it was found as a downy substance—a sort of wool—upon trees; there are also expressions giving the idea that this material was spread upon trees by the feet of insects. There can be no doubt that the early silk-culturists of the East kept, or rather, left the larvæ on the trees where they first found them. It is asserted that the Silkworm is still to be found living freely on the mulberry trees in the vicinity of Hangchow, where the insect is known as *Tien tse*, *i. e.*, the Son of Heaven. This is supposed by the Chinese to be the primordial race of silkworms, whence the do-

mestic varieties have sprung; it deposits its eggs directly on the branches of the trees.*

There is a very well known Chinese legend that attributes to a queen the arts by which silk has been made useful to mankind. If she had lived in an age when inventors took out patents, she might have based her claims for originality on three points: first, collecting the insects in a place prepared for them, where she herself fed them; second, reeling the fiber from the cocoons; third, making garments of silk. These claims would not be invalidated by the fact that her husband, the emperor Hoang Ti, suggested the experiments to her and urged the attempt for the sake of the happiness of his people. He seems to have thought that the product of the Silkworm could be utilized; she is credited with the actual performance. Her

[Fig. 40.]



MULBERRY SILKWORM: cocoon (after Riley).

grateful subjects have accorded to her divine honors; she is the Goddess of Silkworms. The ceremonies of worshipping this divinity, whose name is Si ling chi, are performed at the season of the year when the eggs of the Silkworm are hatched. Silk-culture in China is closely inwoven with religious observances, and the details are given with minuteness in the Book of Rites by Confucius. Authorities differ enormously in fixing the date of Hoang Ti's reign; it was probably not less than 1,800 nor more than 2,600 years before the Christian era. He was the third emperor of China; another of the monarchs of that country has a high place in their pantheon because he encouraged the cultivation of the mulberry tree. The early historic books of the Chinese describe the occupation of different provinces successively, and, in connection therewith, mention instances where, in different localities, the culture of the mulberry was then begun.

[Fig. 41.]

MULBERRY SILKWORM: moth (after Riley).

While the date at which the Silkworm first became useful was very much later in Japan than in China, it is equally shrouded by the mists of a great antiquity. The legends are wholly mythologic; but though none of them have an historic dignity much above folk-lore, there is one that has permanently fixed itself in the Japanese language by conferring technical terms on the stages of the silkworm's growth.

A certain king of India had many wives and a considerable family; but the wife whom he loved best had borne him no children. At last, however, she announced to him that she was about to become a mother, and the king took a far deeper interest in the event than was usual with him on such occasions. He hoped to have an heir that would at a future day worthily fill the throne. Great was his disappointment when the midwives brought to him a daughter instead of a son. He made a most unfatherly remark about the baby; this was repeated in the palace, and came to the ears of the mother, to whose illness it gave an unhappy turn, so that the king was soon called upon to lament her loss. The double sorrow and remorse for his hasty words preyed upon the heart of the king, and before many weeks he was buried with his much-loved consort.

The baby, known as Youan Thsan, was left in charge of some of its numerous stepmothers, who, very naturally, soon

*Le Cocon de Soie: E. Duseigneur—Kelber: Paris, 1875.

found that it was in the way of their ambitious projects. To get rid of the infant, they exposed it in a wilderness where lions resorted. Presently a young whelp approached the child and threatened attack or at all events undue familiarity. "Who art thou?" asked the infant, confronting her enemy boldly. "My father is the king of beasts," replied the young lion. "But my father," haughtily rejoined Youan Thsan, "was the king of men!" Thereat the whelp was abashed, and withdrew to summon the older lions; in his absence the child escaped, and found her way back to the palace.

Then the stepmothers took Youan Thsan to a valley that was frequented by eagles, and left her there. Soon one of these birds seized the child and carried it to the eyrie in a lofty tree. As soon as the old bird had departed, the child looked around in the nest, and demanded of the eaglets, "Who are you?" They answered, "Our father is the king of birds;" and then Youan Thsan discomfited them with such a rejoinder as she had made to the lion. Of course, after that, she clambered out of the nest and returned to the palace again. This time the stepmothers put her on a desolate island. She would certainly have perished there but for the timely arrival of a fisherman, who came in a canoe. He at first claimed her as his property, since he had a right to whatever might be stranded on the island. But she told him that her father was the king of kings and of men; and so, the fisherman took her up tenderly, gave her a sail in his canoe, and brought her back again to her royal home.

"Really, we must put a stop to these adventures," said the stepmothers, and they took the princess out and buried her in the courtyard of the palace. But the laborers who performed the burial were touched with compassion, and threw the sods on so lightly that the child found room to breathe. That night an earthquake shook the palace, and out of the cloven ground Youan Thsan stepped forth unharmed. But the malice of the stepmothers was not abated, and ultimately they devised a successful plan. They put the infant in a hollow mulberry tree and launched this on the ocean. After long tossing on the waves, the tree with its precious freight was dashed on the shores of Japan. The unhappy child, exhausted by exposure and shipwreck, died just at the moment when her frail bark reached the land. But a pitying heaven looked down, and transformed her into a Silkworm that fed on the mulberry tree. Of course, the tree took root, and eventually supported a numerous brood of silkworms. To this day the successive molts of the larva are known in Japan as the time of the lion, of the eagle, of the canoe, and of the courtyard. The great lion's head is carried annually, in a festival procession, through the streets of Yedo.

According to the Nihonji, silkworm eggs and mulberry trees were brought from China to Japan, and the trees first planted in the latter country, A. D. 462. There is a myth which describes the Silkworm as originating from the root-follicle of an eyelash extracted from a Japanese virgin. The likeness of such follicles to larvæ, is doubtless embalmed in many traditions; the wagoner of queen Mab, Shakespeare tells us, was "not half so large as a round little worm, plucked from the lazy finger of a maid." In Japanese pictorial art the Silkworm and the goat are often associated, perhaps because both are apt to feed on leaves in a ravenous manner.

(To be continued.)

In France the bee-keeper is obliged to keep his hives one hundred and ten yards from neighboring property, to lessen injury to persons and to fruit.

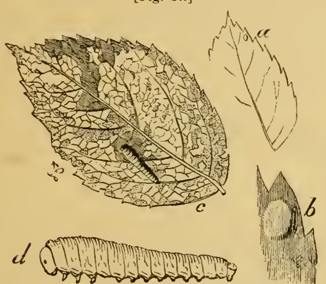
Moth issuing from a Larva.—At the November 5 meeting of the London Entomological Society, Mr. J. Jenner Weir exhibited a specimen of *Orgyia* which was said to have issued from the larva skin without passing through the pupa stage. Where the female is so degraded and larviform as in this genus, such an anomaly is less striking or remarkable than it otherwise would be.

THE ROSE-SLUG.

(*Selandria rosæ* Harris.)

The main points in the history of this well-known garden pest are given by Harris in his "Insects Injurious to Vegetation," etc. It undoubtedly originated in New England, probably upon *Rosa lucida* or *R. blanda*, as these are the species of wild Rose upon which it preferably feeds. Dr. Harris first observed it in the gardens of Cambridge, Mass., in 1831, and mentions that it was six or seven years before it made its appearance in Milton, where he then resided. So far as can be ascertained

[Fig. 42.]



SELANDRIA ROSÆ: *a*, egg, natural size; *b*, do. enlarged; *c*, slug and its work, natural size,; *d*, do. enlarged (after Riley).

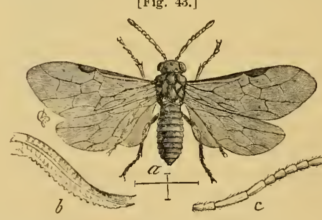
it is not indigenous to any of the States west of the Alleghanies. It has, however, been abundantly disseminated over these States by means of rose bushes imported from eastern nurseries. As it spreads very slowly *on the wing*, had our nurserymen and florists understood its habits and taken the precautions which such knowledge would have suggested, our western gardens might long have enjoyed immunity from its ravages.

Since Harris's descriptions may not be accessible to all our readers we will briefly recapitulate the more important facts. The small, sluggish, black flies (Fig. 43, *a*) emerge from the ground about the time that the roses are in full leaf, and within a few days thereafter begin depositing their eggs. The process of oviposition and the appearance of the newly-hatched slug are thus described by Miss M. E. Murtfeldt in an article contributed to the November number of the *Gardeners' Monthly:*—"With their saw-like ovipositors the female flies pierce the edges of the leaves and force their eggs singly, towards the tip of the serrations, beneath the cuticle on the under surface. The egg is circular, about one-twentieth of an inch in diameter, and so flat at first as to be imperceptible except upon the closest scrutiny. It hatches in eight or ten days, and, before the larva escapes, swells considerably, appearing like a minute blister on the under side of the leaf, within which the coiled embryo is distinctly visible. The young slug upon emerging is one-tenth of an inch in length and of the diameter of No. 30 spool cotton—the round, tawny-yellow head being the broadest part. The color is greenish-white with a dark green vesicular line as soon as it begins to feed."

It feeds only at night, except in very cloudy weather, and exclusively upon the upper surface of the leaf, from which it gnaws the parenchyma, leaving the veins intact. During the day it rests motionless on the under side of the leaf.

The larval life of this insect extends over a period of fourteen or fifteen days, during which it molts four times. The full-

[Fig. 43.]



SELANDRIA ROSÆ:—*a*, female fly; *b*, her saws; *c*, her antenna—enlarged (after Riley).

grown slug is rather more than one-third of an inch in length, by one-ninth in diameter. The thoracic joints are somewhat swollen and humped, but not puffed out laterally, as in some closely allied species, nor has it, like these, a slimy surface. The color is a translucent dull yellow, becoming more opaque at the last molt. Soon after this it enters the ground, and incloses itself in a fragile, earthen cocoon, within which it remains dormant

for many months, not changing to pupa until late the following spring. Harris's assertion that it is *double-brooded* has long been doubted by careful observers and is unquestionably disproved by Miss Murtfeldt's experiments.

Owing to the longevity of the flies and the different dates at which they emerge, there is a succession of the larvæ, covering a period of from four to six weeks; but they are all of the same brood, and when once they have entered the ground, that is the end of them for the season.

The Rose Slug, like most other insects, has a large number of natural enemies, but these are not yet adequate to the task of keeping it in check. The attention of florists has, therefore, been largely directed to the discovery of some reliable artificial remedy.

Various applications have been tried with more or less success, among which the most certain in its effects is whale oil soap suds, made in the proportions of one pound of the soap to eight gallons of water. The objections to this remedy are that it has a disagreeable odor and is liable to discolor the opening buds. Dusting freely with powdered White Hellebore has also been tried with very good success, and it may be used in water by dissolving a tablespoonful of the powder in two gallons of boiling water. The Pyrethrum powders have as yet been used only to a limited extent, but with the prospect that thoroughly applied they would prove effectual. Lime has long been used with satisfactory results, especially if applied when the dew is on the plants.

Capt. E. H. Beebe of Galena, Ill., wrote some time since to the *Gardeners' Monthly* that he had found powdered sulphur applied when the leaves were wet, certain destruction, and Miss E. A. Smith corroborates his experience (*Prairie Farmer*, May 4th, 1878). Wood ashes were strongly recommended in the *Country Gentleman* for June 13th, 1871. The Paris Green mixture has been used with excellent results on bushes where it was not desired to cut or pluck the flowers, but in view of the other available means of destruction is not to be recommended. All applications should be made just at night, as they are then more certain of coming in contact with the insects. Something can also be done to prevent the flies from maturing. As the cocoon in which the larva hibernates is very frail, and as the latter does not survive the rupture of the same, it follows that many of the insects may be killed by thoroughly stirring and pulverizing the soil of rose beds. Roses that are transplanted from one locality to another should, before setting, be immersed in a tub of water and have every particle of soil washed from their roots. By observing this precaution newly-made gardens may be secured for a long time against this worst enemy of the fairest flower.

THE COLORADO POTATO-BEETLE.

RETROSPECTIVE.

Some sixty years ago, or in 1819, the United States Government fitted out an exploring expedition to the Northwest Territories under the command of Major Stephen H. Long. The zoölogist of this expedition was Mr. Thomas Say of Philadelphia, whose name has since become so familiar to every entomologist. While on this expedition, extending through 1819 and 1820, numerous specimens of a species of beetle were found on the upper Missouri, near the base of the Rocky Mountains, which some four years later (1824) Mr. Say described in a paper read before the Academy of Natural Sciences, Philadelphia, under the name of *Doryphora 10-lineata*, an insect that has since received the common name of Colorado Potato-beetle.

At the time of its discovery, neither Mr. Say nor any of his associates could have had the remotest idea that this insect would at some future day become one of the greatest pests that ever afflicted the farms and gardens of this country. Later explorers, visiting the same regions of country where Mr. Say originally found the "ten-liners," discovered it feeding on

a wild species of *Solanum* (*S. rostratum*), a plant allied to and belonging to the same genus as the cultivated Potato (*Solanum tuberosum*). The pioneers on the western plains and prairies little imagined that they were in such close proximity to an insect that would soon give them an immense amount of trouble, and make the cultivation of the Potato anything but a pleasant or profitable occupation. But in 1861, Mr. Thos. Murphy of Atchison, Kansas, reported that they were so numerous in his garden that he was enabled in a very short time to gather two bushels of them. His Potatoes were quickly destroyed, and the beetles then spread in all directions. In the same year they appeared in other parts of Iowa, and from there passed eastward, crossing the Mississippi River in 1864, appearing in several localities almost simultaneously within the State of Illinois. In stating that this insect passes from one locality to another, it must not be understood that it migrates, it merely spreads, enough remaining behind to keep up an abundant stock, and they are probably no less abundant on the western plains at this time than when first discovered there by Mr. Say, sixty years ago. The sudden and enormous increase in numbers, as noted in Kansas and Iowa, was wholly due to the increase in the supply of food, for so long as this insect had to depend upon the few scattering plants of the wild Solanum, as found on the plains, its numbers were limited to a few thousands, or perhaps hundreds to the square mile; but as an acre of Potatoes will probably furnish more food than all the wild plants on a hundred of prairie, the sudden increase of this pest when it reached the out-lying settlements or farms of Kansas, Nebraska and Iowa, can readily be accounted for.

At first the progress of the beetles eastward was at the rate of about sixty or seventy-five miles annually, but as they reached the more thickly settled regions their progress was more rapid, probably receiving some assistance from the railroads, specimens flying into the cars at some western station and escaping at another a hundred or two miles eastward, or in whatever direction the train may have been going. That the beetles were in many instances scattered over the country by such means can scarcely be questioned, as they were frequently found in the cars that had passed through infested regions.

[Fig. 44.]

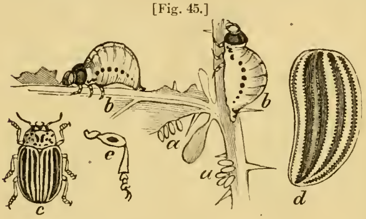
Colorado Potato-beetle: *a*, *a*, eggs; *b*, *b*, *b*, larvæ in different stages of growth; *c*, pupa; *d*, *d*, beetle, back and side views—natural size; *e*, left wing-cover, showing punctation; *f*, leg—enlarged (after Riley).

EASILY CONFOUNDED WITH AN ALLIED SPECIES.

This beetle is now too well known to need description, but it may be well to note that there is a closely allied species (*D. juncta*, Germar,) that is frequently confounded with the genuine "ten-liner," although it never attacks the Potato, but feeds upon various species of wild Solanum, but especially the Horse-nettle (*Solanum carolinense*), a very common weed, especially in the Middle and Southern States. Both the larva and mature insect of this Bogus Potato-beetle resemble the genuine; but upon a close examination, a very marked difference may be discovered. The most prominent distinctive characteristics observed in the nearly mature larvæ are as follow: In the true or *D. 10-lineata*

the sides are ornamented with two rows of black dots, and the head is black ; while in *juncta* there is but one row of dots, and the head is of a pale color, the first joint behind the head reddish-brown and edged with black. The mature insects differ still more widely, for while *10-lineata*, as the name indicates, has ten black stripes on its elytra, the third and fourth stripe, counting from the outside, are joined behind ; in *juncta*, the second and third are joined, and in a large proportion the two stripes are united the entire length, by deep brown, or black, thus forming one broad and conspicuous stripe. There are also other distinctive characters, shown in the accompanying figures, such as the arrangements

[Fig. 45.]



Bogus Colorado Potato-beetle.—*a*, *a*, eggs ; *b*, *b*, larva ; *c*, beetle—natural size ; *d*, left wing cover, showing punctation ; *e*, leg—enlarged (after Riley).

of the punctures bordering the stripes on the elytra, but these are less conspicuous to the casual observer.

A few years since, I tried to rear a quantity of the larvæ sent me from the south on the leaves of the Potato, but failed to carry a single specimen through to maturity on such food. The grubs will, when deprived of other and more agreeable food, attack the Potato leaves, but after eating a few moments, crawl away, and unless supplied with more of the Horse-nettle, soon die. But the genuine *10-lineata* is not so particular in regard to its food, since the Horse-nettle and various other species of *Solanum* are just as acceptable as the Potato, and the Egg-plant (*S. melongena*) is preferred to either. On a pinch it will even feed on Jamestown-weed (*Datura*), Cabbage or Smart-weed, though it is questionable whether it could thrive for any length of time on plants belonging to other families than that of the Potato. For a number of years after this insect appeared east of the Mississippi, there were many persons in the Western States who would not believe that it was a new and distinct species from the one (the *Doryphora juncta*) that had long been known as infesting the Horse-nettles growing on their farms and along the roadsides, and even some very close observers in such matters declared that their old acquaintance had suddenly acquired a taste for the Potato. But entomologists soon proved to the farmers of the west that they had a new foe to deal with.—A. S. F.

(To be continued.)

THE HESSIAN FLY.*

HABITS AND NATURAL HISTORY.

Number of Broods.—The Hessian Fly is double-brooded, the "flaxseeds" or puparia (Fig. 46, *c*) being found on the winter wheat from late in the autumn, through the winter, until the early part or middle of April. The "flaxseeds" of this brood, from one to about twenty in number, are situated between the stalk and sheathing base of the leaf, at the roots of the young grain, slightly beneath the surface of the ground. The "flaxseeds" of the second generation affect the wheat in the late spring and summer, and are situated higher up, or an inch or two above the surface of the ground, at the lower joints of the straw. "In the ordinary course of nature, therefore," says Fitch, "our crops of winter wheat are liable to two attacks of the Hessian Fly, one generation reared at its roots producing another, which occupies the lower joints of the stalks. Thus the larvæ and pupæ are present in it almost continually, from the time the tender young blades appear above the ground in autumn till the grain ripens and is harvested the next summer. Our spring wheat, on the other hand, can rear but one brood of these insects ; they consequently resort to it but little, if at all. Nor can the Hessian Fly sustain itself except in districts where winter wheat is cultivated, in which for it

*From advance sheeets of Bulletin No. 4, U. S. Entomological Commission, by A. S. Packard, Jr., M.D.

to nestle during the autumn and winter."

While, then, as a general rule there are two broods of the fly, the first laying their eggs late in April and in May, and the second flies again issue forth, and the cycle of changes for the year is complete." Thus we see that the flies are ready for work in the Fall, much before the wheat is ready

[Fig. 46.]

HESSIAN FLY: *a*, egg; *b*, larva; *c*, flaxseed stage or puparium; *d*, pupa; *e*, female fly, natural size, laying her eggs; *f*, side view of ♀; *g*, side view of ♂; *h*, the swollen stem where the flaxseeds remain; *i*, back view of the parasite, *Semiotellus destructor* Say (after Packard).

appearing late in August, during September, and perhaps a few early in October, Prof. Cook, who observed the fly in Michigan, says that "in July and August the for them, and may attack a volunteer crop long before the usual crop is above ground, or even sown.

A third brood may sometimes appear, as

shown by Mr. B. Hulick of Michigan, according to Prof. Cook. Mr. Hulick found the empty flaxseeds in volunteer wheat in September. On Prof. Cook's expressing some doubt whether the fly had issued, suggesting that it might be the parasites that had eaten the fly and come forth, as the time appeared to him too short, Mr. Hulick at once planted some of the volunteer wheat, still containing the flaxseed in close jars, and "saw many of the flies issue, and more, had eggs laid by these flies on the same wheat in October. Mr. Hulick showed these flies and their eggs to several of his neighbors. In this case the eggs were deposited in July, the flaxseed state assumed in September, from which came a third brood of flies in October. This is certainly a very important matter, as it shows that three broods are possible under favorable conditions; that while the flies may, nay generally must, wait till September to deposit eggs, they only want opportunity to breed their mischief much earlier, even in July or August, and thus propagate a late brood of flies, which will be in readiness for even the latest sown wheat. No doubt, too, as in the case of all insects, varying degrees of heat or cold will accelerate or retard the various transformations."*

Mode of egg laying (see Fig. 46, *e*, the fly of its natural size engaged in laying eggs). The mode of oviposition has thus been described by Mr. Herrick: "The eggs are laid in the long creases or furrows of the upper surface of the leaves (*i. e.* the blade or strap-shaped part) of the young wheat plant. While depositing her eggs, the insect stands with her head towards the point or extremity of the leaf, and at various distances between the point and where the leaf joins and surrounds the stalk. The number found on a single leaf varies from a single egg up to thirty, or even more." Prof. Cook says that "the fly very rarely lays more than three eggs at one time, without change of position. She more frequently lays two, and generally but one. In case she lays but one it takes less than a quarter of a minute, and less than half a minute to lay three, when they are all laid without a change of position on the part of the fly. After laying she seems to draw in her ovipositor soon to extend it again, at the same time crowding into it the one, two or three eggs that are next to be laid. She then flies to another leaf, alighting usually, not always, with head towards the leaf. She then appears to wipe the eggs off the jointed ovipositor. She really crowds the egg till the end touches the leaf, when, by friction of the leaf and adhesion of the egg, the latter is held fast, while the egg-tube is withdrawn. If the second and third are to be laid, she repeats the operation, after which she retracts her ovipositor, restocks it, and in a trice is depositing the fatal germs on another leaf. I say usually on the upper surface, for occasionally eggs are laid on the stalk, and sometimes on the under side of a leaf. I have observed that the fly often makes unsuccessful efforts to cause the eggs to adhere on the outer face of the leaf before she succeeds. I have seen a fly work thus for two minutes before success crowned her efforts."*

* * * * * *

Prof. C. V. Riley thus described the process in the *New York Weekly Tribune* of March 7th, 1878: "I have very carefully studied the oviposition of the Hessian Fly, closely observing the female in the act on several occasions; and as accurate observations on this point are not easily made, I herewith transcribe my notes of several years ago:

Eggs deposited in irregular rows in the longitudinal cavities and depressions of wheat stalks between the stalk and sheath, when this is loose, or on the leaves between the natural ridges or carinæ of the upper surface, this last being the common habit. Ordinarily there are from five to ten in a row, but sometimes more. Each egg is .02 inch long, cylindrical, rounded at each end, soft, translucent, and pale orange-red in color. Before hatching the pale sides of the inclosed larva show through the shell. Larva hatched in four days, crawls down leaf to base of sheath, which on young grain is at crown of root. The orange-red color is soon lost, and the larva becomes

*A Lecture before the Farmers' Institute at Paw Paw, Mich., 1878, p. 9.

**Lec. cit.* p. 7.

pale, translucent and plump, sinking more or less into the stalk by the depleting process kept up.

"In an article in a St. Louis paper I described, last June, the process of oviposition on the leaves, and my own observations in Missouri accord entirely with those of E. Tilghman, recorded in 1820, and of E. C. Herrick, in 1844, and quoted by Fitch in his essay on the Hessian Fly (Albany, 1846), with the exception that they do not mention the exceptional habit of pushing the eggs between the loose sheath and the stalk, owing doubtless to the fact that their observations were made solely on the autumn brood of flies ovipositing on the young plants, the habit being more common in the early summer brood when the plants are larger."*

Mr. William Strong of Kalamazoo County, Michigan, thus describes the process, adding some particulars of interest:

I have seen the wheat plant with many of the maggots at work, before there was any stalk for the fly to lay its eggs on, by introducing its extensile abdomen tip under the leaf sheath. Even this Fall I have seen this very thing when there was as yet but one shoot from the kernel, which was sowed with a drill, that if the fly had deposited the eggs under the leaf on the stalk, if there had been one there, she would have been obliged to use a spade to dig to get a chance.

* * * * * * * *

A reason given by some why the fly does not injure red wheat as much as white, is because the leaf of the red grows so long and slants down from the shoot, so that when the egg hatches, the maggot works down the wrong way, falls to the ground, and so many fail to harm the wheat.

The flies of the second brood are, in Southern Michigan, ready to deposit their eggs late in April or early in May "on spring wheat or barley which is sufficiently advanced, in lieu of which they deposit on the wheat again, not on the basal or radical leaves, but on the leaves which will be above the first or second, rarely the third joints." (Cook.)

Habits of the Larva.—As soon as the footless larva (Fig. 46, *b*) or maggot hatches, it makes its way down the leaf to the base of the sheath, which in the young winter wheat is at the crown of the root. "Here," says Herrick, "it fastens, lengthwise and head downwards, to the tender stalk, and lives upon the sap. It does not gnaw the stalk, nor does it enter the central cavity thereof; but as the larva increases in size, it gradually becomes imbedded in the substance of the stalk. After taking its station, the larva moves no more, gradually loses its reddish color and wrinkled appearance, becomes plump and torpid, is at first semi-translucent, and then more and more clouded with internal white spots, and when near maturity, the middle of the intestinal parts is of a greenish color. In five or six weeks (varying with the season) the larva begins to turn brown, and soon becomes of a bright chestnut color, bearing some resemblance to a flaxseed."

DR. ASA FITCH.

In the death of Dr. Asa Fitch, Economic Entomology in this country has lost its oldest and ablest votary, and as a follower in the path he so worthily trod, we reverently pay brief tribute to the memory of one who spent the larger part of his life in the untiring and successful study of the insects injurious to agriculture and horticulture. While his earlier writings were contemporaneous with those of Harris, and his later ones with those of Walsh, he will, judged by the work he did, rank first among the fathers of applied entomology in America.

From a biographical sketch of the deceased, by E. P. Thurston, in a late number of the *Popular Science Monthly*, and from additional notes in *Psyche*, and the *American Naturalist*, we draw the following information:

Dr. Fitch was the second son of the Hon. Asa Fitch, M. D., and was born February 24, 1809, at Fitch's Point, Salem, Washington County, New York. Having visited the academy at the village of Salem, he entered, in his eighteenth year, the Rensselaer School at Troy, where he soon became interested in natural history, and especially in entomology. He graduated with honor with the class of 1827 and, at the instance of his father, began immediately afterward a course of medical studies at the Vermont Academy of Medicine, at Castleton. Here he continued to give much of his time to the study of insects.

He graduated as M. D. in 1829, and afterwards attended lectures at Rutgers Medical College, in New York. In 1830 he accompanied, as Assistant Professor of Natural History, the Rensselaer School Expedition to Lake Erie, and leaving the expedition at its western terminus, he traveled extensively in the Western States, collecting and studying insects. On his return east in 1831, he practiced medicine for eight years, first at Fort Miller, N. Y., and then at Stillwater, N. Y. In 1838 he gave up practice and returned to Salem, to assume the management of his father's business.

From this time on he devoted himself largely to agricultural pursuits, which gave more opportunities for investigations in entomology. In 1844 he published his first entomological paper, "Insects of the genus *Cecidomyia*," in vol. 1 of the *American Journal of Science and Agriculture*, and during the next ten years several other papers by him, mostly on injurious insects, appeared in various periodicals.

In that year Dr. Fitch was appointed State Entomologist of New York, and held the position seventeen years. The fourteen Reports on the Noxious, Beneficial, and other Insects of the State of New York, which he made during this time, were published in the Transactions of the New York State Agricultural Society, from 1854 to 1870, and greatly enhanced their value. The first nine of these Reports were published separately in three volumes (1, 2, | 3, 4, 5, | 6, 7, 8, 9), with full indices.

Dr. Fitch lived to the age of seventy, and died at his home, April 8, 1879.

There are several amusing anecdotes related of Dr. Fitch which all serve to illustrate his keen powers of observation and his untiring zeal, and his success was a legitimate consequence of his patience and perseverance. As early as 1840 he thus laid down for himself the following definite plan of action:

"I have undertaken a very great work, and have laid upon myself a task both hard in the plan and difficult in the execution. To unite in one very limited body the most essential facts of the history of insects; to class them with precision and accuracy in a natural series; to delineate the chief traits in their physiognomy; to trace in a laconic and strict manner their distinctive characters, and follow a course which shall correspond with the progress of the science and the eminent men who have contributed to its advancement; to single out the useful and obnoxious species, those which from their manner of living interest our curiosity; to mark the thousand sources where the knowledge of the original authors may be consulted; to render to Entomology that amiable simplicity which she has had in the times of Linnæus, of Geoffroy, and of the first productions of Fabricius, and yet present her as she is to-day, with all the richness which she has acquired from observation, but without surcharging her with it; to conform her, in one word, to the model which I have under my eyes, the work of Cuvier—such is the end which I have taken upon myself to attain."

His published works, taken together with the immense number of unpublished notes which he has left, shows that he accomplished, as far as one man could, the labor he had imposed upon himself.

In company with Mr. P. R. Uhler we enjoyed a brief visit to Fitch's Point and a day's delightful communion with the object of our sketch, in the Fall of 1870. It was the first and last time we had the pleasure of meeting him. He had then been suffering for some time from illness and was very much bowed down. A strong and very tall man, he had become quite round-shouldered from the force of stooping in pursuit of his studies, while the constant use of microscope and lens had produced a noticeable contrast in the appearance of his left as compared with his right eye. Genial, enthusiastic, unassuming, he made a most favorable impression. He had for some years before that ceased to correspond with the entomologists of the day; nor did he afterward change in this particular. In fact, for nearly a decade he has, so far as work is concerned, been dead to the entomological world.

His position as State Entomologist; his connection and correspondence with many of the leading entomologists of this country as well as of Europe, and his own untiring energy as a collector, enabled him to bring together a very rich and valuable collection. At the time of our visit we found a large part of it in poor condition, principally on account of mold

which had resulted from the moisture in his "office" and the use of the French "*cartons liégés*" which do not keep out the moisture so well as wooden boxes; but we are glad to learn from those who have lately examined it that, as a whole, the collection is yet in a state of good preservation. It is valuable not only because it contains the types of the insects described by Fitch, but because of the notes which accompany the specimens. Each specimen has a number referring to these notes, which fill 148 books and amount to about fifty-five thousand.

Efforts were made some two years ago to have Dr. Fitch revise his Reports for republication, and we believe that a bill was passed authorizing such republication. We also learn that the New York Legislature is even now considering the question of appointing an entomologist as his successor. We sincerely hope that the friends of the movement will succeed, and that some capable, thorough and conscientious worker, like Mr. J. A. Lintner, will be given the means to follow in the footsteps of his illustrious predecessor. The collection and the unpublished notes should be well cared for by the State, and the reports republished, so as to be placed at the disposal of the many who desire them, but who, because of their scarcity, cannot obtain them.

We are gratified at the hearty welcome accorded our Bulletin on the Cotton Worm by the press of the South. The facts contained in it are being liberally quoted and disseminated, and Congress has ordered an extra edition. Applicants for the same will most quickly obtain it by addressing the representative or senator from their district. The call for the Bulletin by Prof. Thomas on the Chinch Bug is also great, and Congress has likewise ordered extra copies thereof. A Bulletin on the Hessian Fly by Dr. Packard, from which we quote in this issue, is going through the press.

The Grain Aphis (*Siphonophora avenæ* Fabr.) is unusually abundant this spring.

Flea-beetle on Young Tobacco Plants.—Serious complaint comes from the tobacco-growing sections, of the injury of the "flea-bug," by which is meant one of the common flea-beetles, and probably *Haltica* [*Epitrix*] *cucumeris* Harr., which infests a great variety of different plants. In many parts of Kentucky the young tobacco plants have been literally cleaned off, and farmers are burning and sowing new beds.

Whether the species above cited is the one concerned or not, we shall be glad to determine, if any of our Kentucky subscribers will send us specimens.

[Fig. 47.]

Cucumber Flea-beetle.

Our common *Epitrix hirtpennis* Melsh., does considerable damage to tobacco plants on the Bahama Islands by completely riddling the leaves, and thus rendering them unfit for use. In the States this species occurs almost everywhere east of the Rocky Mountains, but does not appear to be injurious, as it feeds on the leaves of various wild species of *Solanum*. *E. brevis* Schwarz occurs on *Solanum nigrum* in the Southern and Southwestern States; *E. fuscula* Cr. and *lobata* Cr. which in all probability cannot be considered as distinct species, occur frequently in the Southern States upon many different species of plants, but have not hitherto been common enough to do any serious damage. Nothing is known of the habits of the Californian *E. subcrinita* Lec.

Technical Names.—The subjects of the insect world, for instance, are specifically so numerous that one common appellation often includes a large and indefinite number of species. So much so, indeed, that it is rarely we can safely use the definite article *the* in alluding to them. Of what specific value are such common names as "Pinchbug," "Dungbeetle," "Hammerbug," "Woodborer," "Plant-louse," "Grasshopper," "Butterfly," "Moth," "Bumblebee," "Blowfly," or even "Potato-beetle," "Curculio," and "Phylloxera"—the last two being popularized

scientific terms—since some of these names may cover hundreds, or even thousands of distinct species. Even in such classes as quadrupeds and birds the systematic common names are becoming almost as complicated as their scientific names, comparatively limited as their numbers are. Again, take the class which includes the marine and fresh water shells, hundreds of which, to a common observer, look alike and yet are specifically different, and contemplate the difficulty of giving them all common names. * * * It is all folly to assume that the reasonably intelligent among the human family can not become educated up to a general comprehension of scientific literature, for scientific technology is not peculiar to natural history alone. There is scarcely a mechanical, professional or commercial occupation that has not its peculiar technology. Place in the hands of a man of acknowledged intelligence, on other subjects, a list of the different garments, and the fabrics which compose them, which enter into a lady's toilet of the present day, and see how much he will understand about the names, qualities and materials; and yet a little miss, scarcely in her teens, may know all about them, and may be able to repeat their names as glibly as her A B Cs ; and a boy ten or a dozen years old, may be able to lay his hand immediately upon a thousand articles in a drug store, all of which bear Latin names. Why, the very cut-throats, burglars, pickpockets, pugilists and the habitues of the cockpit have a sort of flash technology that is perfectly intelligible to them, but "all Greek" to the honest and unsophisticated. It seems impossible that all the brain should have been monopolized by these and others to whom we have alluded, and none accorded to farmers, gardeners, and fruit-growers. We must confess that, personally, we have often wished that scientific descriptions had been couched in somewhat plainer language, but at the same time we are compelled to acknowledge its impracticability. We never feel quite sure that we perfectly understand what the animal or plant is that an author is describing who entirely discards or ignores scientific nomenclature. We feel like a mariner at sea without a compass ; although he may not fully understand the minute details of the instrument, yet so far as he *does* understand, it is to him an infallible guide. We must educate ourselves up to an intelligent standard on this subject as well as on others, and meet the efforts that are being made to popularize science, at least half way, and to do this there needs to be provision made for it in our systems of public instruction. The *curriculum* of the school need not be lumbered unnecessarily with scientific technology, but should have sufficient to guide the student in any occupation he may afterward select as his business of life. Under any circumstances all elementary education is but rudimental, and only becomes useful when it is reduced to practice, and especially so when it becomes a part and parcel of our daily calling, and is interwoven with our pecuniary interests. The name, the nature, the habits and the forms of the animals existing in the districts we have chosen for our inheritance, become, as it were, a part of our stock in trade, and a knowledge of them is as essential to the successful farmer as a knowledge of composts and fertilizers, or of agricultural implements and how to use them. And the longer we live, the more we improve and cultivate the land, the more attention will have to be paid to the incidental checks and drawbacks to agricultural progress.—*Lancaster Farmer.*

Extensive destruction of the Cotton Worm.—The Hon. J. Floyd King of Louisiana, in ordering a number of copies of our Bulletin on the Cotton Worm, remarks :

> I myself can mention an instance of administering poison to the Cotton Worm on over 3,000 acres of land in one year. The application was simply Paris green and water. The year I refer to was 1873, when the worm was most fatal in its ravages throughout the Mississippi Valley, and I saved my crop when all around me it failed.

"Three blow-flies will devour the body of a dead horse as quickly as will a lion."—*Linnæus.*

Apple Worm Traps.—It is quite unnecessary in order to successfully fight the Codling Moth, that we have the bands with the latest date of the patent office on them. During the past season I applied iron bands to some apple trees and found that the larva of the Codling Moth (*Carpocapsa pomonella*) had no preference between an iron bedstead without mattress of any kind, and one made of soft leather or paper with the softest of woolen or cotton mattress in which to slumber. In other words, the larva of the Codling Moth can be entrapped under the simplest and cheapest band, be it made of paper, cloth, or leather, so long as the bark of the tree is kept smooth and no sticks or fences are near.—Chas. D. Zimmermann.

Value of an Entomological Magazine to Fruit-growers.— Every bee-keeper who wishes to know what is going on in the bee world takes a paper devoted to bees, of course. A breeder of fine cattle can't do without the *Live Stock Journal*. The gardener or nurseryman must have the *Gardeners' Monthly* or else he is behind the times. Now why do *we* fruit-growers grope about as with a smoky lantern for remedies for insects, sure to pick up some self-acting "sure cure" for the Curculio or other pest, that some editor invented to fill up his columns. Why not take a paper on the subject that will give us sound advice (no patent-medicine remedies), and whose editor will be glad to receive specimens of troublesome insects, give us the name and a remedy. Is the subject not of enough importance?

When a thief steals a peck of apples (value about 10c.), some of us will invest from $5.00 to $25.00 for lawyer's advice, etc., how best to capture the thief. But when the Codling Moth breaks into our orchards and destroys from one-fourth to one-half of our crop, we are not willing to give an entomological lawyer $2.00 a year to keep us posted as to how best to fight the insect thieves.—Chas. D. Zimmermann, before the *Western New York Horticultural Society*.

The Proboscis of the common House-fly.—There have been published a good many descriptions of this organ, some of them illustrated by drawings under the microscope, more or less coarse and inaccurate. It is a pleasure to read so thorough a paper on the subject as that by Prof. Macloskie in the March number of the *American Naturalist*. He finds that there is formed a set of teeth on the circum-oral rods and intervening between the roots of the false tracheæ. In some species he finds three rows of these teeth, each tooth two-cusped, while others have but one row, each tooth being three-cusped, and suggests that these differences are of generic value, a suggestion, however, which we think will not meet with much following. He shows pretty conclusively that the suggestion, made nearly a century ago by Gleichen but generally rejected, that inflation is used to protrude the proboscis in addition to muscular action, is correct, the protrusion and distension being a joint affair, the tracheal system and the muscles combining in the work.

In searching for the homologies of the fulcrum of the proboscis he finds it in the endocranium of the insects of other Orders, and the endocranium of the Cockroach shows that all the parts correspond exactly with the retracted proboscis of the House-fly. "We have thus," he concludes, "fallen upon a modification of a structure dependent on metamorphosis of function, almost as striking as that which exists between the suspensor of a bird's mandible and the small bones of the human ear."

Notes on South American Lepidoptera.—At the February 6th meeting of the London (Eng.) Entomological Society, as reported in the *Entomologists' Monthly Magazine*, Mr. Meldola read extracts from a letter to Mr. Darwin from Dr. Fritz Müller, from Santa Catharina, Brazil, concerning the habits, etc., of several South American Lepidoptera. One of the *Sphingidæ* in that locality had a proboscis (exhibited) of 22 centimetres in length. Another species of the same family exhaled a strong scent, which proceeded from an

odoriferous organ indicated by two pencils of hairs at the base of the abdomen. The flowers of a species of Lantana are yellow the first day, orange the second, and purple the third, and Dr. Müller entered into interesting details with respect to the species of butterflies that respectively visited the flowers in their different conditions of coloration, proving considerable appreciation of color in these insects. Finally, he alluded to a secondary sexual character existing in the genus *Calidryas* and some others, the costal margin of the anterior-wings being sharply serrated in the ♂ and smooth in the ♀. Mr. Meldola said that in the British Museum there is a South American specimen of *Macrosila cluentius* with a proboscis 23.5 centimetres (9¼ inches) in length.

Early Silk Culture in Virginia.—How many times silk culture has promised to be one of the great industries in this country, and then almost passed out of sight and mind, may be inferred from the following reference to silk culture in Virginia which appears in the second edition of Evelyn's Sylva, published in London, Eng., 1669. In speaking of the various products of the world, the author says: "I will also instance in that which is now in good forwardness; Virginia has already given silk for the clothing of our kings; and it may happen hereafter to give clothes to a great part of Europe and a vast treasure to our kings. If the silk-worm shall thrive there (of which there seems to be no doubt) the profit will be inexpressible." After two centuries, we can still say "there seems to be no doubt" of the success of the silkworm in Virginia, and all there is wanting is that Virginians shall go to work and raise the silk.—A. S. F.

Vitality of the Sheep Scab.—Writing under date of December 12th, 1879, Mr. F. C. Lewis, Chief Sheep Inspector of New Zealand, says that Mr. W. McLaughlin of Papatoitoi, in the month of October, 1877, placed some five or six acari, with a small quantity of wool and scab matter, between two flat pieces of glass, having the edges inclosed by gummed paper. The original insects have died; but about ten young acari, of various sizes—the largest about the sixth of the full size—were alive last month, and have been preserved for future examination. These experiments, says the *Pacific Rural Press*, as well as others that might be adduced, demonstrate the tenacity of life pertaining tothe scab insect, and confirm the necessity that exists for prolonged and careful precautions being applied in cases of sheep infected with the scab disease.

Cabbage-worm Parasite.—We notice that correspondents of the agricultural and horticultural press when referring to the *Pteromalus purparum*, or Imported Cabbage-worm parasite, generally state that the female fly deposits her eggs in the pupa or chrysalis. This however, is incorrect, as any one can discover by gathering some of the infested full-grown caterpillars and placing them in a close box to undergo their transformation. The flies, instead of laying their eggs upon the chrysalides, deposit them in the caterpillar while this is feeding on the cabbages or other closely allied plants in the garden. The minute parasitic grubs resulting, bore into and feed upon the fatty substance of the unfortunate caterpillar, but do not kill it, or prevent it from crawling away and successfully passing into its chrysalis state. But after this change the parasites continue to eat until the entire substance within the chrysalis skin is destroyed, the skin itself protecting them until the following spring, when, having changed to flies, they break through the shell of their victim, and escape.—A. S. F.

Floating Apiaries.—Last year a very interesting experiment was tried by Mr. C. O. Perrine of Chicago, who believed that he could very materially extend the honey-producing season by floating his apiary on a barge down the Mississippi late in the season, and then returning

northward with the advancing season the subsequent year, leaving the colonies meanwhile in the south. The experiment, the results of which were looked forward to with a good deal of interest by the apiarists of this country, has been abandoned as unprofitable, and our old-time friend, M. M. Baldridge of St. Charles, Ill., has made arrangements to take charge of most of the colonies during the season. The bees laden with stores are too apt, in crossing the water, to fall short of reaching the barge. They are also liable to be chilled by the cool, shifting breezes that prevail near large bodies of running water. Thus large numbers of them perished. The bees (some 600 stands) will be moved in future by rail.

American Staphylinidæ wanted.—The French entomologist, Mr. Albert Fauvel, so well known by his papers on the *Staphylinidæ* of the Old World as well of Central and South America, published about a year ago the first part of his paper on the *Staphylinidæ* of North America. This volume of 100 pages is invaluable to the Coleopterists of this country. A speedy continuation of the work is promised by M. Fauvel, who appeals to American collectors to furnish him with material, so as to render the work as complete as possible, the specimens—named or unnamed—to be sent per post to M. Fauvel (rue d'Auge 16, Caen, France), who will return them authentically determined.

Probable Parthenogenesis in the Hessian Fly.—Dr. Hagen gives, in the March number of our contemporary the *North American Entomologist*, reasons to believe that parthenogenesis may occur in the common Hessian Fly (*Cecidomyia destructor*). He also raises the question as to whether this insect is still common and injurious in this country. It is beyond doubt less injurious in the older wheat growing sections of the country than formerly; for the ravages of the insect have extended westward with the well known movement in the same direction of wheat culture. In the great wheat-growing States its ravages continue and the agricultural journals give just as much space to its consideration as of yore. As with nearly all insect enemies of our crops it prevails more in some years than in others—especially in hot and moist ones—but during our residence in Missouri there was no year when it was not in some sections reported. The fact that it is scarce in entomological cabinets may be explained on much the same grounds that insects like the common Mosquito and House Fly are equally rare in such cabinets. *Cecidomyia destructor* is represented in our cabinet in all stages, either mounted dry or in balsam.

Raspberries destroyed by Weevils.—A species of weevil or snout-beetle, the *Otiorhynchus picipes*, has of late years been very destructive to raspberry plantations in England. In 1878 a fruit-grower in Cornwall, reported the destruction of two acres of plants, and since that time the pest seems to have spread quite rapidly, and the past season many plantations were attacked in different parts of England. The weevil not only strips the leaves from the plants, but destroys the tender shoots and eats the bark from the growing canes. Gathering the beetle with a sweep-net after dark, has thus far proved to be the most efficacious method of destroying this pest. Our importers of plants should be on their guard against introducing this weevil, as it would no doubt flourish in this country, as we have already several closely allied species belonging to the same genus.

Errata.—Page 98, col. 1, line 19, for "*habillarde*" read "*babillarde* (*Curruca garrula* Briss);" col. 2, line 13 from bottom, for "so minute a prey" read "such minute prey." Page 99, col. 2, line 26, for "cut-worm or green worm" read "cut-worms or green worms." Page 97, col. 2, line 8 from bottom, for "attracting" read "attacking."

ON OUR TABLE.

Annual Report of the Entomological Society of theProvince of Ontario, for the year 1879. 8vo. pp. 89. 57 illustrations. Toronto, 1880. From the Society.

Descriptions of some new *Tineina*, with notes on a few old species. By V. T. Chambers. 8vo. pp. 26. pl. 4. (From the Journal of the Cincinnati Society of Natural History, January 1880.) From the Author.

Ueber einige neue oder unvollkommen gekannte Daphniden. Von August Gruber und Dr. August Weismann. 8vo. pp. 57. 5 plates. Friburg, 1877. From the Authors.

Studien zur Descendenz—Theorie. 1.—Ueber den Saison—Dimorphismus der Schmetterlinge. Von Dr. August Weismann. 8vo. pp. 94. 2 plates. Leipzig. 1875. From the Author.

Oenologischer Jahresbericht. Bericht über die Fortschritte in Wissenschaft und Praxis auf dem Gesammtgebiete von Rebbau, Weinbereitung und Kellerwirthschaft, erstattet unter Mitwirkung von Dr. O. Saare, Von Dr. C. Weigelt. Erster Jahrgang 1878. 8vo. pp. 178. Berlin, 1880. From the Author.

Note sur les Expositions Horticoles. Par Ch. Joly. 8vo. pp. 11. (Ext. du Journal de la Société centrale d' Horticulture de France.) From the Author.

The Transactions of the Academy of Science of St. Louis. Vol. IV. No. 1. 8vo. pp. 230. 6 plates. 3 maps. St. Louis, Mo. 1880. From the Academy.

Some Thoughts and Facts concerning the Food of Man. By Dr. E. L. Sturtevant. 8vo. pp. 42. (From the Report of the Secretary of Conn. Board of Agriculture, 1880.) From the Author.

Vick's Floral Guide. Spring, 1880. 8vo. pp. 91. Illustrated. Rochester, N. Y. From the Publisher.

Catalogue Raisonné des Animaux. Utiles et Nuisibles de la France. Par Maurice Girard. Seconde édition 8vo. Fascicule I. Animaux Utiles, leurs services et leur conservation. pp. 181. Fascicules II. Animaux Nuisibles, dégats qu'ils produisent, moyens de les détruire. pp. 223. Paris. 1879. From the Author.

Le Phylloxera. Par Maurice Girard. 16mo. pp 120. Troisième édition. Avec gravures et carte. Paris. 1880. From the Author.

Bulletin de la Société Centrale d' Agriculture et des comices Agricoles du Départment de l' Herault. 66me Année. 8vo. pp. 334. Montpellier, France. 1880. From the Society.

Our Homes. By Henry Hartshorne, A. M., M. D. 16mo. pp. 149. Illustrated. Presley Blakiston. Philadelphia. 1880. Price 50 cents.—This is one of the most valuable of the popular American Health Primer Series, and should be in the hands, not only of every house-builder, but of every housekeeper. Light, warmth, ventilation, drainage and water supply, are things of vital importance to general and individual welfare, and Dr. Hartshorne's teachings on these subjects will well reward careful attention.

Vick's Flower and Vegetable Garden. 8vo. pp. 166. 6 plates. Price 50 cents. James Vick, Rochester, N. Y.—To say that this work is worthy of its publisher, is to affirm, to all who are familiar with "Vick's Illustrated Monthly," that it is perfect of its kind. In addition to the plates, which are exquisitely colored, there are innumerable illustrations, most pages having from six to fourteen. Those who need information respecting the history or character of almost any cultivated plant, will find it in these pages, with full descriptions given and modes of culture explained. Noteworthy among the contents are an illustrated *Botanical Glossary* and a *Pronouncing Vocabulary of Botanical Names*. The value of this book by far transcends its price, and its usefulness is equaled by its beauty.

EXTRACTS FROM CORRESPONDENCE.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

Reduction in Price of Pyrethrum.—We have reduced the price of powder in eight-pound cans to seventy-five cents per pound, and our next crop will be principally put up in barrels and cans, which we anticipate reducing still further. Having planted over five hundred acres last fall, we expect to commence grinding about the 25th of June next. We shall increase the production of the plants from year to year, and will endeavor to place it within the reach of all, hoping that by putting up a pure article we may soon be able to drive out of market the adulterated stuff which is now imported, and we shall leave the consumers to adulterate it themselves, as in their experiments they may need to.—G. N. Milco.

A Natural Insecticide.—There has been recently discovered in Schuylkill Co. a shale which decomposes easily and rapidly, and which is being considerably used as a fertilizer and bug killer. I am told that neither the Chinch nor any other bug will attack vegetation growing in a soil fertilized by this material. An analysis shows it to contain sulphuric acid, iron, alum, humic acid.—C. A. Green, M. D., Lancaster, Pa.

Cotton culture and the insects affecting the plant at Bahia, Brazil.—Cotton is not grown at present to any considerable extent in this Province and has ceased to be an article of exportation. The cultivation is simple in the extreme, requiring little care or attention, but owing to the distance from this part of the cotton producing districts, the cultivation has long since ceased to be remunerative.

The insect enemies of the cotton plant which particularly attack it, consist of two species of moths which in the form of worms or caterpillars prey upon its leaves and stalk as also the cotton pod itself. It is also attacked by a peculiar species of bug, a specimen of which is forwarded, and by the grasshoppers, which commit great ravages on the foliage and the tender stalks.

The "Cotton Worm" as described by Prof. Riley is somewhat different from the worm found in this Province, differing in color and other respects, but it is no doubt of very similar character.

The ravage committed by them is greater in the dry or summer months, say September, October, November, and December.

This Cotton Worm is believed to have been always in the country, and not imported.

Cotton has been grown in this part of Brazil for as long a time as any other production, and it is also found growing wild.

The prevailing direction of the wind during the months of March, April, June, and July is easterly, varying from N. E. to S. E.—Richard A. Edes, U. S. Consul, Bahia, Brazil.

[Mr. Edes kindly accompanied his communication with specimens, upon which we will add a few remarks. The worm that takes the place of our Aletia is, both by the colored drawing and the specimens sent, easily distinguished from Aletia. The four moths are in poor condition and show some variation. The species is one of the smallest of the genus *Anomis*, and between *illita Gn.* and Hübner's figure of *exacta*, of which Prof. Grote kindly had a copy made for us. In the larva the front pair of abdominal prolegs is perfectly obsolete and the second pair of nearly

the same size as the others The piliferous spots are reddish without pale annulation. The chrysalis has the cremaster less swollen at tip, but otherwise, except in smaller size, is undistinguishable.

The egg is so similar to that of Aletia that it is doubtful whether there are any constant distinguishing characters; the ribs in the single specimen examined are somewhat fewer in number and consequently more marked.

That this is the "Cotton Worm" of Bahia is interesting from the fact that Aletia was described by Hübner from that place. If, as we cannot well doubt, Mr. Grote has correctly determined Hübner's figure of Aletia to represent Say's *Noctua xylina*, it will also yet be found there. There is a possibility, however, that the figure has misled, and the description of Hübner is certainly of no value as a guide.

The cotton bolls contained the following insects, which all appear to have fed upon the seeds: (1) a small *Tineid*, badly rubbed but distinct from the species so abundantly found in the U. S. under similar conditions and which is figured by Prof. Glover as possibly *T. granella*. but is, as Mr. Chambers informs us, a new species of *Laverna*. It is, however, a different species. (2) A species of *Hypothenemus*, apparently not differing from *H. hispidulus*, which has also been found in diseased cotton bolls in the U. S. and on the Bahama Islands and which also bores in the twigs of the dead plants. (3) Two specimens of a *Paratenetus*, differing from the allied North American *P. punctatus* which is found in diseased cotton bolls in the U. S. by its very strongly dentate thorax. (4) One specimen of a *Diplocœlus* not occurring in the U. S. (5) Four specimens of *Aræocerus fasciculatus*, a cosmopolitan beetle found in articles of commerce and frequently observed in diseased cotton bolls in the Southern States.

The large bug is the Cotton Stainer (*Dysdercus suturellus* H. S.) also found in the U. S. and greatly injurious to cotton on the Bahamas.]

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Hemispherical Larva at bottom of Ant Hill.—Will you favor me with the name of the specimen which I inclose? It was found in the bottom of an ant hill. One specimen died before it was put in alcohol—the black one.

I am glad you have started your ENTOMOLOGIST again. I sincerely trust it will prove a success. —D. S. Sheldon, Davenport, Iowa.

The curious objects you send, which, in the shape of body and sculpture of the upper surface resemble very closely certain kinds of naked snails, are the apparently full grown larvæ of a two-winged fly (*Microdon globosus*), belonging to the family *Syrphidæ*. There seems to be but little known of the life history of these insects. Packard, who figures the larva, puparium and imago of this species (*vide* "Guide to the Study of Insects," 3d ed. p. 398, Fig. 317), says that the larva was found by Mr. Sanborn, under sticks, in company with shells. What relation these larvæ have to the ants is not known, and we should be very glad to receive from you further facts on this subject. Mr. Schwarz informs us that while looking for beetles in the hills of a reddish ant near Ann Arbor, Mich., he found this larva in the innermost portion of the hill.

Chrysalides dug up in Cotton Field, mistaken for those of the Cotton Worm.—Will you oblige me by mailing to me a copy of the Communication referred to in the inclosed slip from the "*Tribune*:"

Prof. Riley in a communication just made public, upon the *hibernation of the cotton-worm*, states, as a summary of our present knowledge of the subject, that the Aletia never hibernates as egg, larva or chrysalis, and that it survives the Winter only in the Southern portion of the cotton-belt in the moth or perfect stage. Hibernation seems more common in the Western part of this belt than the Eastern portion, and consequently it is here that the earliest appearance of the worm is noticed.

If what that paper states is really "a summary" of the knowledge arrived at with reference to the hibernation of the Cotton Worm, I acknowledge myself, vulgarly speaking, "stumped." The fact is that in the process of plowing (in sandy land) during the past month, I have noticed hundreds of the larva or chrysalis of the Cotton Worm, alive and kicking, healthy looking, thrown up.—Robert Worrel, St. Joseph, La.

We can only refer you to what we have said on the subject of hibernation of Aletia in chapter 10 of Bulletin No. 3 of the U. S. Entomological Commission as reprinted in the January number of this magazine. We recommend that you carefully compare the larvæ and chrysalides found in the ground and supposed by you to be those of Aletia, with the figures we have given. If this comparison does not satisfy you, keep your chrysalides, covered with a little soil, in a closed glass jar, and compare the moths which will issue therefrom with the figure of Aletia which we have given. We hope you will then be convinced that your supposition is wrong.

Aleurodes on Oxalis.—Inclosed are leaves from the "Oxalis" infested with an insect new in my experience; be so kind as to say what it is. I fail, with the lens I have, to determine which are eggs and which are larvæ. I shall be very

glad if thy time will allow some attention to the subject.—S. A. Conard, West Grove P. O.

The insect proves to be a species of Aleurodes in different stages of development. The eggs are elongate-oval and of a very light bluish-green color, more whitish toward the margins. They are pretty firmly attached to the surface of the leaf in an upright position by a short spiniform thread. Only one larva was to be found. It is elongate, and of a light green color. Both egg and young larva are difficult to observe, as they are quite small. The pupa is ova', flattened on two sides, uniformly greenish-white with the dark eyes visible through the delicate and transparent shell. It is always firmly fastened to the leaf. Of winged imagos there are quite a number, both males and females, the sexes differing principally in the form of the abdomen. The color of this winged form is bright yellow, eyes brown, antennæ, wings and legs white. This white color disappears entirely when the specimens are mounted in balsam, a fact which shows the importance of describing these insects from living specimens. The species is doubtless undescribed, as very little or no attention has so far been paid to this interesting family in this country.

Larvæ in stomach of Black Bass.—*S. A. F., Normal, Ill.*—Of the two larvæ you send us as having been found in the stomach of a Black Bass (*Micropterus salmoides*). one is too imperfect to admit of determination. All that can be said about it is that it is a Coleopterous larva, perhaps belonging to the *Dascillidæ*. The other larva belongs to the *Dytiscidæ*, is allied to *Cybister*, but differs in the form of the head. From the larva of *Dytiscus* it differs by its very slender maxillary palpi. We take it to be the larva of either *Laccophilus* or *Hydrocanthus*, several species of which are very common.

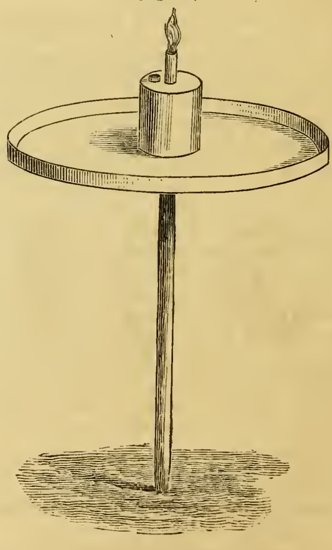
Insects from Stomach of Rock Bass.—I take it for granted that you will be at least as much interested in the subject of the food of fishes as in that of the food of birds, and I therefore send you a minute larva (or a part of one) which is not uncommon in the stomachs of Rock Bass and Sunfishes taken in the Illinois River in July. It is sometimes associated with such aquatic insects as *Corixa tumida*, *Hydroporus*, and larvæ of *Chironomous;* and sometimes (in the common Sunfish, *Lepiopomus pallidus*) with terrestrial insects washed in. I send you as nearly perfect an individual as I have found, taken from the latter species.—S. A. Forbes, Normal, Ill.

Unfortunately the specimen sent by Prof. Forbes came to hand with the anal portion, which is of so much importance in determining many Coleopterous larvæ, (for such it is) entirely wanting. From the general structure of the remainder of the body we should say that it might be the larva of *Cyphon*, in which event it is not strictly aquatic but was washed into the water with mud. That it is Coleopterous there is no question; that it is not aquatic is more than probable; but for the rest there is no certainty.

New Enemy to Sugar Cane.—The beetles of which I send you with this a few specimens have appeared in large quantities upon many of our sugar plantations, and are doing very much damage to our small canes. They eat to the centre of the cane under ground and destroy the inside just above the mother stock for some two inches. As many as 56 have been found in 15 inches length of row They threaten to become a very serious pest. Can you give me any information regarding them and what means, if any, can be taken to protect the sugar plants from them?—D. Th., Pattersonville, St. Mary's Parish, La.

The species is *Ligyrus rugiceps* and has been previously reported to us from the same region of country, especially from Baton Rouge, as injurious to young corn and grasses, in the same

[Fig. 48.]



A simple form of field lamp.

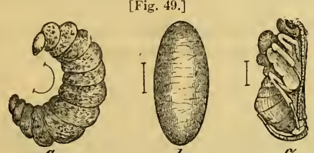
manner as decsribed by our correspondent to sugar cane. We cannot find that this habit of injuring sugar cane by this beetle has been anywhere previously recorded. The natural history of this species is absolutely unknown, so that it is impossible to suggest any remedy based thereon. The beetles are no doubt attracted by light, and might be killed in great numbers by use of the ordinary lamps and kerosene pans employed to attract the Cotton Moth and illustrated in the recent Bulletin which we issued on that insect. We reproduce a figure of one of the simpler forms of these lamps, the pan of which should be partly filled with water and kerosene.

Parasites of the Plum Curculio.—Some of the members of our Ithaca Farmers' Club say that you know of an insect which will kill out the Plum Curculio completely in three years, if introduced and cultivated. They wish to know if this is so, and to cultivate such enemy to the Curculios which have been uncommonly injurious here the past season. For them I make the above inquiry, but am inclined to think somebody has misunderstood you.—W. S. Barnard, Ithaca, N. Y.

The statement alluded to by our correspondent is undoubtedly based upon what we wrote nearly ten years ago on certain parasites of the Plum Curculio, having (3d Missouri Report, pp. 24–29) there shown that there were two such in existence. We quote portions of our account of the most common and wide-spread of these parasites and herewith introduce figures which will cause them to be recognized:

Just 10 [now 20] years ago, in his "Address on the Curculio," delivered at the annual meeting of the N. Y. State Agricultural Society, Dr. Fitch gave an account, accompanied with a figure, of a small Ichneumon-fly which he named *Sigalphus curculionis*, and which he believed was parasitic on the Curculio. Before that time no parasite had ever been known to attack this pestilent little weevil, and even up to the present time it is currently believed that no such parasite exists; for unfortunately the evidence given by Dr. Fitch

[Fig. 49.]



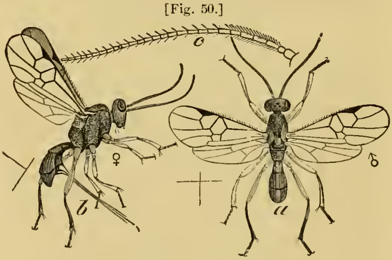
SIGALPHUS CURCULIONIS:—*a*, larva; *b*, cocoon; *c*, pupa (after Riley).

was not sufficient to satisfy some of our most eminent entomologists. These parasites were in fact received by him from Mr. D. W. Beadle of St. Catherines, C. W., who had bred them from Black-knot, from which he bred at the same time a certain number of Curculios; but as other worms besides those of the Curculio are likewise found in Black-knot, we had no absolute proof that this fly was parasitic on the insect in question. Consequently we find that Mr. Walsh, in his Report as Acting State Entomologist of Illinois, rather ridicules the idea of its being a Curculio-pyphen parasite and endeavors to prove that it is parasitic instead on the larva of his Plum Moth (*Semasia prunivora*). But I have this year not only proved that poor Walsh was himself wrong in this particular inference, but that he was equally wrong in supposing his little Plum Moth, so called, to be confined to plums; for I have bred it from Galls (*Quercus frondosa* Bassett); from haws, from crab apples, and abundantly from tame apples.

To be brief, Dr. Fitch's *Sigalphus* is a true parasite on the Plum Curculio and I have bred hundreds of the flies from Curculio larvæ. The first bred specimens gave me much pleasure, for as soon as I saw they belonged to the same genus as Dr. Fitch's fly, I felt assured that another disputed question was settled. But to make assurance doubly sure, I repeatedly half filled large jars with pure earth, finely sifted so that no living animal remained in it. Into these jars I placed Curculio larvæ from day to day as they issued from peaches that were thrown into another vessel, and in due time the parasitic flies began to issue from the ground along with the perfect Curculios. Nay more than this, I soon learned to distinguish such Curculio larvæ as were parasitised, and after they had worried themselves under the ground—seldom more than half an inch—I would uncover them, and on several occasions had the satisfaction of watching the gnawing worm within reduce its victim until finally nothing was left of him. As soon as the Curculio larva is destroyed by the parasite, the latter (Fig. 49, *a*) encloses itself in a tough little yellowish cocoon of silk (Fig. 49, *b*), then gradually assumes the pupa state (Fig. 49, *c*) and at the end of about the same length of time that the Curculio requires to undergo *its* transformations and issue as a beetle, this, its deadly foe, gnaws a hole through its cocoon and issues to the light of day as a black four-winged fly (Fig. 50, *a*, *male*; *b*, *female*). In the vicinity of St. Louis, this fly was so common the past season, that after very careful estimates, I am satisfied three-fourths of all the more early developed Curculio larvæ were destroyed by it.

As Mr. Walsh bred this same parasite from the larvæ of his little Plum Moth, it doubtless at-

[Fig. 50.]



SIGALPHUS CURCULIONIS:—*a*, male, dorsal view; *b*, female, side view (after Riley).

tacks other soft-bodied larvæ and does not confine itself to the Plum Curculio. This is the more likely as it would scarcely pass the winter in the fly state. The female, with that wonderful instinct which is exhibited in such a surpassing degree in the insect world, knows as well as we great Lords of Creation what the little crescent mark upon a peach or plum indicates; and can doubtless tell with more surety, though she never received a lesson from her parents, whether or not a Curculio larva is drilling its way through the fruit. When she has once ascertained the presence of such a larva by aid of her antennæ—which she deftly applies to different parts of the fruit, and which doubtless possess some occult and delicate sense of perception, which, with our comparatively dull senses, we are unable to comprehend—then she pierces the fruit, and with unerring precision, deposits a single egg in her victim, by means of her ovipositor.

Now there is a variety (*rufus*) of this parasite, with the ovipositor nearly one-fifth of an inch long, but in the normal form the ovipositor is only twelve-hundredths of an inch long, and the Curculio larva must therefore be reached soon after it hatches, or while yet very young. Conse-

quently we find that the earliest Curculio larvæ, or those which hatch while the fruit is yet small, are the most subject to be parasitised, and while from larva obtained early in the season, I bred more parasites than Curculios, this order of things was reversed a little later in the year.

Blister Beetles from New Mexico—*J. M., Silver City, N. M.*, have been received. The large Blister Beetle you send is *Macrobasis albida*, very common in the south west, and, as you suggest, beyond doubt valuable as a vesicant. There is no reason why these beetles, where they can be easily obtained in large quantities, should not be used as a substitute for the Spanish Cantharides. The smaller beetle is a *Diplotaxis*, altogether too much broken to determine specifically, and it has not, as far as it is known, any visicatory properties.

Abnormal Cocoon.—I have collected many *Callosamia promethea* (Drury) cocoons here, but to-day I have found on the maple a cocoon suspended like *C. promethea* and having the same general form, but with the following peculiarities: 1, it occurred on a twig of the sugar maple; 2, it is only one-fourth the usual size; 3, it is woven very thin, loose and transparent, without a leaf involved; 4, the moth has already appeared and deposited about fifty eggs in a frothy hard mass over one side of the cocoon. What can this be?
—W. S. B., Ithaca, N. Y.

The cocoon which was kindly sent for inspection is simply a stunted specimen of that of *Orgyia antiqua*. It had been fastened to a twig, which is an abnormal position, and by winds or some other means had become partly detached except at one point, the silk which had been spun along the twig twisting and forming the suspensory band. Its real character is shown alike by the texture of the cocoon, the nature of the eggs and of the chrysalis shell and larval exuvium.

Insects found about Orange Trees.—*J. S. Barnwell, M. D., Darien, Ga.*—The insects you send and which you found on Orange trees are as follow: (1) a species of *Aphis* in various stages of maturity. Whether or not this species has been described is hard to say, but it is the only one among the insects you send which is really injurious to the plant, when it appears in large numbers on the young leaves. Among your specimens are the following enemies of the Aphis just alluded to: (1) a lady-bird (*Chilocorus bivulnerus*), the small, round, shining, black beetle with a red spot on the middle of each wing-case, and the abdomen red; (2) the larva of the foregoing species, which is easily recognizable by its body being covered with very stout, long, black prickly spines; (3) the larva of another lady-bird too much injured to allow any exact determination; (4) a *Syrphus* fly, the larvæ of which genus are known to feed on Aphides. The following species have no particular connection with the Orange trees, and their presence on or near such is merely accidental: (1) *Neoclytus erythrocephalus*, a Longicorn beetle known to bore in Elm, Hackberry and other deciduous trees; (2) *Drasterius amabilis*, the larva of which, belonging to the so-called "Wire Worms," is known to be injurious by feeding on the tender roots of wheat; (3) *Platynus punctiformis*, which is one of the commonest species of Ground-beetles in the Southern States, and which is a very beneficial insect by feeding on injurious species; (4) larvæ of a species of *Forficula* or Earwig, which is frequently met with in the South under old, moist bark, or at the base of trees; (5) *Gryllotalpa borealis* or the northern mole-cricket, an Orthopterous insect widely distributed in this country and very remarkable from the form of its front legs, which resemble the "hands" of a mole. This insect burrows usually in wet ground on the margin of ponds and swamps, but has also been reported occasionally as doing some harm by burrowing in dry ground and cutting off the tender roots of plants. It is, however, by no means as injurious as the European species (*G. vulgaris*); (6) *Psocus venosus*, a Neuropterous insect which is commonly met with in old, dead branches, and feeds upon the lichens and fungi growing in such places. In sending insects in future for determination, it will be well to separate aud number each species, to facilitate reference.

DESCRIPTIVE DEPARTMENT.

LUPERUS BRUNNEUS (*Crotch*).

After a careful examination of the *Luperus* mentioned in our March number as injurious to hollyhocks and corn silk and to which we had given the MS. name of *noxius*, it proves to be but a pale race of *L. brunneus* Crotch. A comparison of the same with a typical specimen of *L. brunneus* which Dr. LeConte has been kind enough to send us shows that the two cannot well be separated specifically. The typical specimen of *brunneus* is of a uniform brown color above and has the elytra sparsely and finely punctulate, while all the specimens from Kansas are of a pale ochreous color with the outer joints of the antennæ, the side margin of thorax, scutellum, suture and side margin of elytra darker. Other specimens in our cabinet from Texas are brown with the thorax ochreous. The sculpture of thorax and elytra varies, being in some specimens finer and sparser than in others.

This species can only be confounded with *L. morulus* Lec., both differing from all other North American species of this genus by the stouter antennæ with the second and third joints together hardly longer than the fourth, and especially by the sexual characters. The last abdominal joint of the ♂ is not transversely impressed but only slightly flattened at middle; it is truncate at apex, and has each side a longitudinal slit extending from the margin to the middle of the joint. This division represents, according to Dr. LeConte (Proc. Ac. Nat. Sc. Phil. 1865, p. 210) the genus *Calomicrus* Stephens. *Luperus morulus* Lec., differs from *brunneus* by its more slender form, its deep black color, less transverse thorax, with the angles less rounded, and by its more finely punctulate surface.

THE

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NOTES ON OUR COMMONER INSECTS.

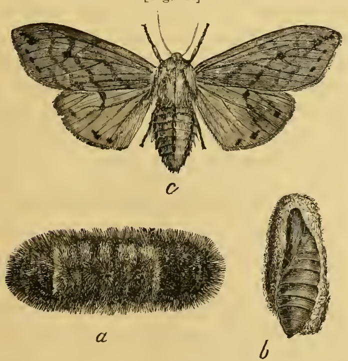
BY THE EDITOR.

The Isabella Tiger-moth

(*Arctia* [*Pyrrharctia*] *isabella*, Smith).

Every one who reads this has doubtless seen the black-and-tan caterpillar which we herewith illustrate (Fig. 51, *a*), but not

[Fig. 51.]



HEDGEHOG CATERPILLAR:—*a*, larva; *b*, cocoon partly cut open to show chrysalis; *c*, moth (after Riley).

every one is familiar with the moth which this caterpillar produces. Harris, in his well-known work on Injurious Insects, gives a figure of the larva and a brief description, and Mr. B. Pickman Mann, in a recent number of *Psyche* (vol. ii, p. 270), gives a further description, with some account of the variations in color, and with the statement that he is not aware of any other published description than that of Harris. On page 143 of our 4th report on the "Insects of Missouri," we gave the following account of it, in connection with the figures here used:

The larva of this insect (Fig. 51, *a*) is very common with us, and is familiarly known by the name of the Hedgehog caterpillar. It is thickly covered with stiff black hairs on each end, and with reddish hairs on the middle of the body. These hairs are pretty evenly and closely shorn, so as to give the animal a velvety look; and as they have a certain elasticity, and the caterpillar curls up at the slightest touch, it generally manages to slip away when taken into the hand. It feeds on plantain, clover, dandelion, grasses, and a variety of other plants, and after passing the winter in some sheltered spot, rolled up like a hedgehog, it comes out in the spring to feed upon the first herbaceous vegetation, and finally spins its cocoon (Fig. 51, *b*) and goes through its transformations. The cocoon is composed principally of the caterpillar's hairs (which are barbed) interwoven with coarse silk. The chrysalis is brown, with tufts of very short, golden bristles, indicating the position of the larval warts, and with a tuft of barbs at the extremity. The moth is of a dull orange color, with the front wings variegated with dusky, and spotted with black, and the hind wings somewhat lighter and also with dark spots.

In some parts of Missouri this caterpillar is called the "Fever-worm," a term which originated in the South, and is more particularly applied to another larger and jet-black caterpillar, with stiffer spines (larva of *Ecpantheria scribonia* Stoll).

There is but one annual generation of this insect in New England and Canada, according to authors, but even that far north fresh moths frequently issue in the Fall of the year. In Missouri they quite commonly issue during August and September, or early enough to beget another generation of larvæ, and there can be little doubt but that the species is double-brooded in the more southern States.

The variation in the color of this cater-

pillar is great. While it is more commonly marked with red and black, as indicated in our figure, the one color often encroaches more or less upon the other, so that we may have every gradation from individuals that are entirely black to those which are entirely red, and we have seen specimens illustrating all the gradations. The very young larvæ usually have most black. But the variation is not confined to the relative amount of these two colors.

In the summer of 1870 we found a larva which had so different an appearance that we naturally concluded that it belonged to some other species. It was uniformly cov-

[Fig. 52.]

Ophion macrurum (from *American Naturalist*).

ered with much larger, rufous hairs, tipped with black. On Sept. 20 of that year it changed its skin, eating up the shed skin entirely, and assumed the normal characteristics given in our figure. Mr. John Hamilton, of Alleghany, Pa., some years afterward communicated to us the following experience of a similar variation :

> I captured several of the imagos near the 1st of September. On the 5th of August I found two larvæ under drift on the river bank, which I did not recognize as *Isabellas* at the time ; they were covered with mouse-colored hair, not evenly clipped in appearance, but long and soft, and among them were blackish-brown ones, about half-and-half on the two anterior and two posterior segments, but scarcely noticeable on the intermediate ones. They spun cocoons on the 6th, and disclosed on the 17th one ♀ and one ♂, the female a regular *Isabella*, the male very pale, and the secondaries almost white. I was quite surprised to discover *Isabellas* disclosing from such larvæ. Other imagos captured a week or two later were all ♀ and without any peculiarity.

At least four distinct parasites attack this caterpillar, a fact which shows that its stiff hairs are no protection to it, and it is noteworthy that all these parasites belong to the group with short ovipositors. We have reared the uniformly honey-yellow *Ophion macrurum* Linn. (Fig. 52), or Long-tailed Ophion, from its chrysalis, the parasite forming a tough cocoon of a deep bronze color within it. We have also reared from it the *Ichneumon cœruleus* Cress., the fly issuing from the chrysalis, but making no cocoon of its own. It is a beautiful, steel-blue species, with yellowish-white marks around the eyes, on the neck and thorax, and on the legs, the female being distinguished from the male by having a mark of the same pale color on the top of the antennæ about their middle, but less white around the eyes, about the face and on the legs. Mr. O. S. Westcott has reared from the Isabella chrysalis another beautiful Ichneumon (*Ichneumon signatipes* Cr.), which is characterized by its black head and thorax and deep brownish-red abdomen, and by a yellowish annulus just beyond the middle of the antennæ, one on each of the tibiæ, and, besides other yellowish marks, one conspicuous spot on the scutellum or about the middle of the thorax. A fourth parasite was reared by Mr. Westcott, namely, the Saffron-horned Trogus (*Trogus obsidianator* Brullé), a large black species, with smoky wings, and the feelers and part of the front legs of a saffron-yellow.

THE ROMANCE OF A CATERPILLAR.

BY WM. C. WYCKOFF.

[*Concluded from p.* 114.]

There is yet another Japanese legend connected with this subject ; it accounts for improvements in the weaver's art. This story has been recently told in a French newspaper, the *Journal de l'Ain*. The Japanese, like the Chinese, regard filial piety as the highest of the virtues. In this respect the hero of the tale, Toung Young, was a model son. When his mother died, he beggared himself to procure a coffin. Shortly afterwards his father also died, and the youth sold himself, so as to be able to meet the expenses of the funeral

and of embalming the remains. These rites finished, Toung Young went to deliver himself to his purchaser. While on his way, he suddenly met a girl of rare and striking beauty. To his great surprise she offered to share his fortunes. He explained the difficulties of his position, and she agreed to go with him to his employer and give her services in weaving. The result of this arrangement was that within a month she wove a hundred pieces of silk of new and marvelous patterns, which she offered as a ransom for Toung Young, and they were accepted. The young man, freed from obligations to his employer, started to return home, along with the beauteous maid, seemingly on domestic bliss intent. But when the time for appreciating blessings has come, they usually take their flight. On reaching the place where they had first met, the girl bade the young man farewell. She had been sent, she told him, from Heaven, to reward his piety ; and now her mission was accomplished. She immediately ascended to the sky. The deserted swain went back to his employer and resumed the business of silk-weaving. By carefully imitating the designs of the fabrics made by the beautiful being, new goods were produced far superior to the ordinary patterns, and the fortunes of Toung Young were assured.

The story of the introduction of the silkworm into Europe has been often told. Two Nestorian monks, it is said, brought the eggs from China. The hollow of the staff which it was customary for every pilgrim to carry, served as a place for concealing the eggs. The monks presented themselves and their curiosities to the Emperor Justinian, A. D. 555. Under their direction the eggs were hatched and the worms fed on leaves of the wild mulberry. From this brood all the silkworms of Europe sprang. Some modern critics have thrown a doubt over this tale. It bears a striking likeness to other and earlier legends. One of these sets forth that Khotan, a country on the Persian Gulf, was and had always been destitute of silkworms and mulberry trees. Unsuccessful efforts had been made to obtain the worms from other nations, and an official embassy encountered refusal. But eventually the coveted insects were procured by stratagem. The daughter of an eastern king was affianced to the sovereign of Khotan, and she brought to him not only herself, but also, enwrapped in her turban, the eggs of the silkworm and the seed of the mulberry tree. There can be no doubt that the secrets of silkworm culture were sedulously guarded by the Chinese for many centuries. At the present day there is a considerable party in Japan opposed to the shipment of silkworm eggs from that country, deeming such export contrary to sound public policy. Nevertheless, large quantities are shipped to France and Italy, every year.

Whether the story of the conveyance of silkworm eggs by Nestorian monks be true or false, it is quite certain that Justinian effected a total revolution in the silk industry. The measures which he took were vigorous and oppressive, the object being to destroy the trade of Persia. It has been said of the great European contest which began with a struggle for the possession of the spice islands, that "all Christendom went to war for the sake of a gillyflower." It would be no exaggeration to say, similarly, that the history of mankind was changed on account of the silkworm. We have the authority of the historian Finlay for asserting that the great transfer of civilization from the Hellenic to the Semitic races, which took place in the sixth century, was largely due to the alterations in the currents of trade which Justinian effected. By diverting the commerce with China from its old course through Persia to a new route by Arabia and the Red Sea, fresh life was stirred in the Saracen race, and a pathway was opened for Mohammed's career.

When the empire of the Saracens was at its zenith, silk culture and silk manufactures were added to the commerce with the farther East, which had already proved a large element of prosperity. The Arabian tales are full of allusions to silk. It was

the material of the tapestry hangings in the great halls of that enchanted castle where the young king of the Black Isles miserably languished, while he received every day a cowhiding at the hands of his unfaithful spouse. The trade in silk, carried by caravans from one city to another, is frequently alluded to: a merchant, dying at Damascus, left, we are told, 100 loads of brocades and other silks there, made up in bales, ready to be sent to Bagdad, and the narrative shows that the son felt it a matter of filial duty as well as a good business venture to carry out his father's project by traveling with the goods to the Moslem capital. The gilded youth of that day, if desirous to see the world, usually made the grand tour in a caravan. Bales of silk formed a considerable part of the riches of the robbers' cave, whose door yielded to the words "Open sesame!" and made the fortunes of Ali Baba. There is a neat story of a practical joke practiced by the Caliph Haroun Alraschid on an obscure citizen of Bagdad: the man was stupefied by a powerful narcotic, and while in this condition was carried into the palace and put to bed. The next morning he was greeted with every attention and ceremony as the Commander of the Faithful, while the real Caliph watched him through a lattice and enjoyed his bewilderment. The fun was fast and furious, but it came very near being spoiled by the uncontrolable mirth that ensued when a pair of silken drawers was handed to the sham Caliph; he had not been used to such luxuries, and he put on the garment as if it were a jacket, drawing its legs over his arms. In another tale, the pomp and wealth of the King of India are described by Sindbad the Sailor in a sort of official report to the Caliph of Bagdad; one of the details is that a thousand men clad in cloth of gold and silk march before the oriental monarch.

The patterns of silk, or their quality, bore at that time some definite relation to the rank of their user. Thus it is related of Zobeide, that when in a strange city, though ignorant of the language and customs, by carefully studying a curtain of silk stuff hung before a gateway, she discovered that this was the entrance to the palace of the reigning prince of the country. But Zŏbeide was peculiarly qualified for this study; she was doubtless a good judge of silk. A small patrimony which she inherited at Bagdad had been invested by her in the business of rearing silkworms. She was so prosperous in producing and selling silk, that she was able to restore the fortunes of each of her sisters when they came to her successively in a state of beggary. Eventually she became rich enough to own and occupy "a magnificent house, whose front was adorned with fine columns, and had a gate of ivory." Haroun Alraschid, in disguise, shared the hospitalities of this mansion one evening; he was charmed with its owner, and made her his wife and the mistress of his harem.

The mystery connected with the production of silk is used to advantage by Shakespeare. The fatal handkerchief whose loss brought about the death of Desdemona, was a silken fabric. Othello tells her,

"There's magic in the web of it.
"A sibyl, that had numbered in the world
"The sun to course two hundred compasses,
"In her prophetic fury sewed the work.
"The worms were hallowed that did breed the silk,
"And it was dyed in mummy, which the skillful
"Conserved, of maidens' hearts."

In Cymbeline, Shakespeare makes one of the characters—Belisarius, a banished lord—say that his free life in the mountains of Wales is "prouder than rustling in unpaid-for silk." The great dramatist has perpetrated many anachronisms, but this happens not to be one of them. There is evidence of the introduction of "seolc" into England as early as the seventh century, which will fairly serve for the time of the tragedy. In an Anglo-saxon marriage described by Strutt, it is specified that the bride was led into church between two sweet boys with laces and rosemary tied about their silken sleeves.

The Abbey of Theleme, according to the veracious chronicles of Rabelais, was to be organized on the principle of having

a system and laws exactly the reverse of those in other monastic establishments. Among the details of this project it is mentioned there was to be, on the lands of the Abbey, a row of houses of the extent of half a league, very neat and cleanly. Therein should dwell the goldsmiths, lapidaries, jewelers, embroiderers, tailors, gold-drawers, velvet weavers, tapestry-makers and upholsterers, "who wrought there every one in his own trade, and all for the aforesaid jolly friars and nuns of the new stamp. They were furnished with matter and stuff from the hands of Seigneur Nausiclete, who every year brought them seven ships from the Perlas and Cannibal Islands, laden with ingots of gold, with raw silk, with pearls and precious stones."

The display of silken garments and of general richness of dress reached its climax in the sixteenth century, on the Field of the Cloth of Gold, where Henry VIII of England and Francis I of France met, and the nobles of both kingdoms vied with one another in extravagance of this kind. It is however related of King Henry that he was so scantily supplied with silken hose that he could not wear it except on gala days. His daughter Elizabeth was not so straitened. She was, indeed, a Flora McFlimsey in the abundance and variety of her dresses, and being presented with a pair of black silk knit stockings in the third year of her reign, she declared that thereafter she would wear no other kind; and to that resolution she adhered. But ladies' hose in the days of Good Queen Bess was far more elaborate than at the present day. Philip Stubbes, in "The Anatomie of Abuses," thus describes the article: "Their netherbockes and stockings in like manner are either of silke, jeansey, worsted, crewell, or at least of as fine yearne, thread or clothe, as is possible to be hadde. Yea they are not ashamed to weare hose of all kinds of chaungeable colours, as green, red, white, russet, tawney and els what. Then these delicate hosen must be cunningly knit and curiously indented in every point with quirkes, clockes, open seame, and everything els accordingly."

The spread of the silk industry since the Elizabethan era has been marked by a variety of incidents well worth narrating, but they are too near us in point of time to be accounted as legendary lore.

THE WHITE GRUB FUNGUS.

BY THE EDITOR.

As this is one of those natural phenomena which always attract the attention of the curious, and as it is one which we quite frequently receive for determination, we will endeavor to give such facts regarding it as are now known, more particularly as we have recently received it from Mr. P. J. Mell, Jr., of the State Agricultural and Mechanical College, Auburn, Ala., under the belief that he had made a recent discovery and with the statement that he intended to publish an account of it under the name of *Torrubia hasta*. We do not know how far back accounts of this fungus may have been published, but it has been repeatedly referred to during the past 15 or 20 years in the agricultural journals of the time, as will at once be seen by the list of references which we give at the end of this article. This list will also show that the fungus occurs over a large extent of the United States, and its distribution is probably co-extensive with that of the larva which it attacks. This is ordinarily the common White Grub, or larva of *Lachnosterna fusca*, but in regions where this species is replaced by allied species of the same genus the fungus will no doubt be found

[Fig. 53.]

White Grub Fungus (after Riley).

upon them also. The two figures (53, 54,) which we introduce, very well illustrate the appearance of this fungus, showing one of the longest and one of the shortest specimens, while Fig. 55 shows the inflorescence as given in the original description by Berkeley. It generally presents the appearance of a pair of elongate horns, one issuing from each side of the head, originating from the soft point lying between the base of the mandibles, maxillæ and front legs. In the many specimens which it has been our privilege to examine, this rule was very general ; very often, however. the growth on one side will be dwarfed, and exceptionally there will be two pairs of the processes, or four in all : one pair on each side, the superior process encircling the base of the antennæ and never developing as fully as the lower ones. In no case have we found it to issue from " the two corners of the mouth where the lower pair of jaws or maxillæ ought to be," as described by our late friend Walsh in the *Practical Entomologist* (vol. ii, p. 116), in which article, by the way, may be found the first suggestion that we are aware of, in this country, of the practical utilization of fungus diseases, so that Walsh really anticipated LeConte in this suggestion. The color is usually gray, inclining to purplish.

We are not aware that the developing of the fungus up to the time of fructification and reproduction has ever been traced, but it offers a very interesting field to mycologists, more particularly that, if it can be reproduced at will by mycelium, as we reproduce mushrooms, we shall have one of the most interesting instances of fungus insecticides and a means of destroying the White Grub far superior to any now at our command ; for, however little faith we may have in the use of beer mash or yeast as a general insecticide, as recommended by Dr. Hagen, we are fully convinced that great good may be accomplished in destroying insects injurious to vegetation, by the study and propagation of those particular fungi that are severally known to attack particular species.

[Fig. 54.]

White Grub Fungus (after Riley).

Some experiments which we made during the year 1870 by planting White Grubs attacked by this fungus, proved interesting in showing that ultimately the head of the fungus enlarges somewhat by the cists forming a spadix, reminding one of the seed-head of an Indian turnip (*Arisæma*). These cists contain what we took to be long, filiform spores, though they may be ascidial asci with an indefinite number of joints, as in *Ascidium.* They dissect into globular frustules of chalky whiteness, which start on an aggregate growth and produce a kind of mold of chalky whiteness. Wounds or sprouts of the main stem seem to give rise to this same white mold.

Regarding the name of this fungus, it was for a long time considered identical with *Torrubia militaris*, of Tulasne, but after considerable correspondence in 1874, 1875 and 1876, with Mr. W. R. Gerard of Poughkeepsie, N. Y., he considered it much nearer to *Torrubia cinerea*, of Tulasne. It is never safe, however, to assume the identity of a fungus of this character unless it can be studied when mature, especially as there are at least a couple of dozen species of *Torrubia* known to inhabit insects. Several of them have been described under the name of *Isaria*, which is recognized to be the conidioid state of *Torrubia.* We have in our cabinet some interesting specimens of this stage affecting wasps of the genus *Polistes*, originating just as the White Grub fungus does, from the base of the mandibles ; while others additional to those mentioned by Berkeley are known to attack the larva of a Cicada and also a species of ant in Brazil ; in the West Indies to occur on wasps, and one in New Guinea on a species of Bark-louse (*Coccus*). An examination of Tulasne's description of *Torrubia cinerea* convinced us that our species was distinct, and feeling the necessity of a name for an object so commonly met with and so repeatedly sent to us, we characterized it in the *Rural World* of June 12, 1875, under the name of *Tor-*

rubia elongata. On April 7, 1879, after examining the very large herbarium and very large collection of Prof. Farlow, of Cambridge, Mass., and the works of Tulasne, Corda, and Lowesky, Dr. Hagen wrote us that we were quite justified in giving it a new name; but later researches have developed the fact, as Dr. Hagen recently wrote us, that the species was described and figured in the Journal of the Proceedings of the Linnean Society for 1857 (vol. i, p. 159), by Berkeley, under the name of *Cordyceps ravenelii*, and as this was doubtless the first description of it connected with a name, the fungus must hereafter be known as *Torrubia ravenelii*—all subsequent names being synonyms.

Mr. Berkeley gives, in the paper already alluded to, the following species of entomogenous species of *Cordyceps* which were at that time known:

- C. *militaris* and *entomorrhiza* are common to Europe and the United States.
- C. *myrmecophila* is found in England and Italy.
- C. *gracilis* in Scotland and Algiers.
- C. *sinensis* in China, where it is used as a drug.
- C. *gunni* and *taylori* in Australia.
- C. *sinclairii* and *robertsii* in New Zealand.
- C. *racemosa* and *falcata* at Myrong in the Khazia mountains of Bengal.
- C. *armeniaca* in South Carolina.
- C. *sobolifera* and *sphecocephala* in the West Indies.
- C. *larvata* in Cayenne.

This list shows that the entomogenous *Sphæriæ* predominate in warm or equable climates. He then describes four other species from South Carolina, and we quote his description of *C. ravenelii* in full, with the simple remark that *Ancylonycha* is the old Dejeanian genus for *Lachnosterna.*

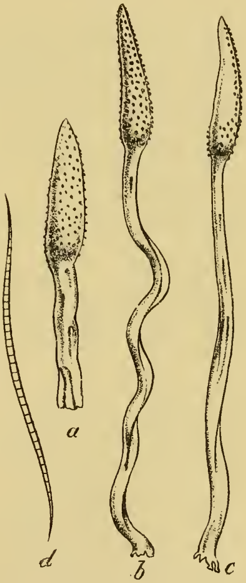
Cordyceps ravenelii, Berk. and Curtis; fusca, stipite elongato flexuoso sulcato compresso glabriusculo, capitulo cylindrico attenuato longiore; peritheciis superficialibus. Curt. No. 3080, Rav. No. 1272.

On larvæ of *Ancylonycha* Dejean, or *Rhizotrogus* Latreille, buried one or two inches in the earth. Spring and summer. South Carolina. Rev. M. A. Curtis and H. W. Ravenel, Esq.

Brown. Stem 2 inches or more high, flexuous, compressed or grooved, at first minutely tomentose, at length smooth; head ¾ inch long, cylindrical, but slightly attenuated at either end. Perithecia free, ovate; asci very long; sporidia (Fig. 55, *a*) very long, filiform, breaking up into joints $\frac{1}{1000}$ of an inch long.

This species has very much the habit of *C. sinensis*, and Mr. Berkeley remarks that none of the entomogenous species described by himself from South Carolina "are completely isolated from the rest, for *Cordyceps palustris* resembles *C. sobolifera; C. stylophora* and *acicularis* are connected

[Fig. 55.]



FRUCTIFICATION OF WHITE GRUB FUNGUS (after Berkeley).

through *C. ravenelii* with *C. sinensis*; and *C. armeniaca* calls to mind the apricot-colored *C. myrmecophila.* Besides these species I have received *C. militaris* from South Carolina, where *C. entomorrhiza* also occurs under a very fine form."

The following references to this fungus are enumerated here as additional to those in purely scientific publications, and because they are liable to be overlooked by mycologists:

Kirtland, J. P. (*Prairie Farmer*, July 29, 1865, p. 71), briefly refers to it, in an article on Pear

Tree Blight, as "a fungoid growth from the larva of the Melolontha or May-bug," as having long been known to be of a vegetable nature.

B. D. Walsh (*Practical Entomologist*, vol. ii, Nos. 11 and 12, p. 116, 1867) refers to a larva of the May-bug, (*Lachnosterna quercina*) attacked by this fungus. This specimen was sent by Mr. Gilbert, of Tipton, Cedar Co., Iowa. "When found the shoot [fungus] was of a light green color, and thrifty." "There were large numbers of such specimens turned up by the plough, and the root [fungus] came from the worm in exactly the same part of the body in all."

B. D. Walsh (*American Entomologist*, vol. i, No. 4, p. 77, December, 1868). The writer refers to this fungus, a specimen of which had been sent to the Sedalia (Pettis Co., Mo.) *Press* by Mr. W. B. Porter. This article is an abstract of Walsh's article in the *Practical Entomologist* referred to above.

American Entomologist (vol. i, No. 5, p. 92, January, 1869) gives a communication of Mr. S. H. Y. Early, of Va., according to whom the White Grub fungus is very common in Virginia, where the negroes believe that it produces a white mushroom which is poisonous and fatal to hogs.

C. V. Riley (*Scientific American*, June 1, 1872). A box with specimens of this fungus had been sent by Mr. A. J. B., of Kansas, for determination, and a figure thereof is given, with an explanation of the fungus growth.

Mr. F. S. (*Rural World*, June 8, 1872,) writes to the editors of that journal that this fungus was very commonly found in Kansas in the spring of 1869 and 1872.

T. J. Burril (*Country Gentleman*, August 27, 1874), while speaking of the depredations of Lachnosterna larvæ mentions that these grubs are also attacked by a fungus "which ultimately grows out of their mouth, three or four times the length of the body of the insect, of course killing it."

T. J. Burril (*Rural World*, May 15 (?), 1874), while speaking of a larva, which, "save its size, corresponds perfectly with that of the common striped squash beetle (*Diabrotica vittata*)" and which was attacked by a fungus in a similar way as the large White Grub (*Lachnosterna fusca*). This fungus he refers to *Cordiceps*.

C. V. Riley (6th Missouri Report, 1874, p. 123), in an article on the White Grub Parasite (*Tiphia inornata* Say) mentions that the White Grub "is at times extensively destroyed by a parasitic cryptogamic plant (*Torrubia militaris* Tul.)," which Mr. W. R. Gerard of Poughkeepsie, N. Y., is inclined to refer to *T. cinerea* Tul. On page 125 this fungus is figured.

C. V. Riley (*Rural World*, June 12, 1875) proposes the name of *Torrubia elongata* for the White Grub fungus, and gives two figures of it. The specimens referred to in this article came from various localities in Missouri.

C. V. Riley (New York Weekly *Tribune*, Oct. 4, 1877), refers briefly to the development of this fungus.

Weekly New York *Sun*, September 12, 1878, mentions the common occurrence of this fungus, especially in the South and West, and the great help this fungus gives in checking the numbers of the White Grubs. A very primitive figure accompanies this article.

E. A. Popenoe (*Kans. Farmer*, date unknown) figures the fungus and briefly describes its appearance, and says that it occurs very numerously in some locality, referring to Riley's 6th Report.

THE HESSIAN FLY.

SUMMARY OF ITS HABITS AND THE MEANS OF CHECKING IT.*

1. There are two broods of the fly, the first laying their eggs on the leaves of the young wheat from early April till the end of May, the time varying with the latitude and weather; the second brood appearing during August and September, and laying about 30 eggs on the leaves of the young winter wheat.

2. The eggs hatch in about four days after they are laid; several of the maggots or larvæ make their way down to the sheathing base of the leaf and remain between the base of the leaves and the stem, near the roots, causing the stalks to swell and the plant to turn yellow and die. By the end of November, or from 30 to 40 days after the wheat is sown, they assume the "flaxseed" state, and may, on removing the lower leaves, be found as little brown, oval, cylindrical, smooth bodies, a little smaller than grains of rice. They remain in the wheat until during warm weather in April, when the larva rapidly transforms into the pupa within its flaxseed-skin, the fly emerging from the flaxseed case about the end of April. The eggs laid by this first or spring brood of flies, soon hatch; the second brood of maggots live but a few weeks; the flaxseed state is soon undergone and the autumn or second brood of flies appear in August. (In some cases there may be two autumn broods, the earliest August brood giving rise to a third set of flies in September.)

3. There are several destructive Ichneumon parasites of the Hessian Fly, whose combined attacks are supposed to destroy about nine-tenths of all the flies hatched; of these the most important is the Chalcid four-winged fly (*Semiotellus destructor*), which infests the flaxseed; and the egg-parasite (*Platygaster*).

4. By sowing a part of the wheat early, and if affected by the fly, ploughing and sowing the rest after September 20th, the

*From advanced sheets of Bulletin No. 4, U. S. E. C., by A. S. Packard, Jr., M. D.

wheat crop may in most cases be saved. It should be remembered that the first brood should be thus circumvented or destroyed in order that a second brood may not appear.

5. If the wheat be only partially affected it may be saved by fertilizers and careful cultivation ; or a badly damaged field of winter wheat may thus be recuperated in the spring.

6. Pasturing with sheep and consequent close cropping of the winter wheat in November and early December may cause many of the eggs, larvæ and flaxseeds to be destroyed ; also, rolling the ground may have nearly the same effect.

7. Sowing hardy varieties. The Underhill Mediterranean wheat, and especially the Clawson variety, which tillers vigorously, should be sown in preference to the slighter, less vigorous kinds, in a region much infested by the fly. The early August sown wheat might be Diehl, the late sown Clawson.

8. Of special remedies, the use of lime, soot or salt may be recommended; also raking off the stubble ; but too close cutting of the wheat and burning of the stubble are of doubtful use, as this destroys the useful parasites as well as the flies.

PROBABLE GEOGRAPHICAL LIMITS OF THE HESSIAN FLY.

The question naturally arises whether this pest will ever infest the wheat regions of Western Dakota, Montana, Utah, Colorado, and the Pacific States and Territories. We believe not, though aware that such a statement may be hazardous. It was originally an inhabitant of Central and Southern Europe ; it has become acclimated in the Eastern, Atlantic and Middle States, in the valley of the upper St. Lawrence and in the valley of the Mississippi River ; that it can thrive in the elevated, dry Rocky Mountain plateau regions, withstand the cool nights and dry, hot atmosphere of the Far West, seems very doubtful. At least so slowly has it spread westward ; so slight an amount of wheat or straw is transported, all produce of this kind going eastward, that we doubt whether during this century at least it will extend west of Kansas and Minnesota, where it has already had a foothold for several years.

THE TRUE AND THE BOGUS YUCCA MOTH ; WITH REMARKS ON THE POLLINATION OF YUCCA.

BY THE EDITOR.

In our first article on *Pronuba yuccasella*, read before the St. Louis Academy of Science, September 2, 1872, we referred to a smaller, apodous larva that is frequently found in the seed-pods of *Yucca aloifolia*, sometimes in considerable numbers, feeding upon the flesh of the fruit. We stated at the time that "it may be traced from slight depressions on the outside, and shows Hymenopterous affinities. It occasionally gnaws into the seed from the outside, but its legless character at once distinguishes it from the larva of *Pronuba*." In our attempts to get further specimens of the larva and to rear it, we have been led to the discovery of the curious little moth characterized in the Descriptive Department of this number as *Prodoxus decipiens*. For while the larva certainly does show "Hymenopterous affinities" and is well calculated to deceive, especially when it has the pale color, as when found inhabiting the fruit as above quoted, yet it turns out to be Lepidopterous. Further experience shows, however, that it is by no means confined to the fruit, but infests far more commonly the flower-stems of different species of *Yucca* and particularly *Y. rupicola*. In the winter and spring of 1879 we received flower-stems of *Y. aloifolia* and *Y. gloriosa* collected on different occasions in various Southern States by Mr. E. A. Schwarz and containing this larva. The moth was reared by us from these specimens in considerable numbers in May 1879. The species proved to be identical with specimens received some years before from Dr. J. H. Mellichamp, of Bluffton, S. C., who took them from Yucca flowers. Though smaller in size and lacking some of the essential

characters of *Pronuba*, it nevertheless so closely resembles it in general appearance that upon studying its characters we marked it in our cabinet with the name with which it is here christened. In passing through Dallas, Texas, in July 1879, we stopped over to make a call on Mr. Jacob Boll, having learned that he had also bred what he considered to be *Pronuba* from the flower-stems of *Y. rupicola*, and we at once saw that the insect which he had so bred was this *Prodoxus*. Before the Entomological Club of the American Association for the Advancement of Science, at its meeting in Saratoga last August, we gave a brief account of this *Prodoxus*, showing how it differs from *Pronuba* in the genitalia of the male; in wanting the characteristic maxillary tentacle of the female; in inclining to maculation; in the larva having no legs; in the characters of the chrysalis, and in habit. We also ventured the opinion that its existence accounted for various experiences that led Messrs Boll and Chambers to certain unwarranted conclusions regarding Pronuba.

In a paper on the fertilization of *Yucca*, read before section B, at the same meeting of the Association, Mr. Thomas Meehan, editor of the *Gardeners' Monthly*, gave some experience with the fructification of *Yucca angustifolia*, endeavoring to show that *Pronuba* is always abundant in the flowers of this species of *Yucca*, which blooms two or three weeks earlier than *Y. filamentosa*, but that notwithstanding the presence of *Pronuba* the former plant never produced fruit unless he himself artificially pollinized it. We then made the point that the moths seen by Mr. Meehan upon the flowers of *Yucca angustifolia* were probably this *Prodoxus*, in which event the inference which Mr. Meehan drew from his facts, namely, that because *Pronuba* did not pollinize *Y. angustifolia*, therefore it did not pollinize *Y. filamentosa*, would fall to the ground, as would also the statements in the following paragraph which we quote from his paper:

> *Pronuba yuccasella*, the Yucca Moth, has for years abounded on my flowers of the *Yucca filamentosa*. It has not been known to visit any other plant than Yucca. *Yucca angustifolia* begins to flower from three to two weeks and its blossoming is all over before *Yucca filamentosa* begins to open. The facts now adduced show that the moths exist weeks before the flowers bloom with which they have been so intimately connected, feeding of course on other flowers, and would perhaps make use of other fruits as depositaries for their eggs if Yucca should not exist. At any rate the facts weaken any belief we may have that the Yucca and Yucca Moth, through the long ages, have become mutually adapted to each other through a fancied mutual benefit.

We recently learned from Mr. Meehan that he had discovered and sent to Dr. Hagen, of Cambridge, what the latter considered a Coleopterous larva, boring in the flower-stem of *Yucca*, and we at once inferred that this might possibly be the same larva with which we are now dealing, its presence in Mr. Meehan's plants giving fresh warrant for the explanation which we offered of his facts presented last autumn. Dr. Hagen has not been willing to favor us with a specimen of said larva, but informed us recently that it had transformed and proved to be *not* Coleopterous.

We have long been familiar with the facts brought forward by Mr. Meehan as to the non-seeding of *Yucca angustifolia*, and in a paper read before the St. Louis Academy of Science (vol. iii, p. 570), thus alluded to them:

> An interesting fact connected with Yucca pollination came to my notice in the summer of 1876. I have elsewhere shown that the *Pronuba* larva, as it lies in the cocoon underground, is not susceptible to the forcing influences that hasten the development of most other insects. The moths usually issue in St. Louis too late to pollinize the flowers of *Yucca angustifolia*. This species blooms from two to three weeks earlier than *Y. filamentosa*, which, with its varieties, is most commonly cultivated. As a consequence, the former very rarely produces seed. One of the rare occasions on which it did so was in the year stated, in the garden of Dr. Engelmann. All the early flowers at the base of the raceme fell infertile, but a few of the very latest at the apex were fructified, and, as the subsequent discovery of the *Pronuba* larva in the capsules proved, they had been duly visited by the moth.

It was undoubtedly this *Prodoxus* which caused Mr. V. T. Chambers to assert that *Pronuba yuccasella* was sometimes spotted, and which led us (*loc. cit.*) to make the following criticism of his statement:

"In a recent Bulletin of Hayden's *Geological and Geographical Survey of the Territories* (vol. iii, No. 1) is an extended article by Mr. V. T. Chambers on 'The Tineina of Colorado,' in which, on the very first page (121 of the Bulletin) the following paragraph occurs:

"*Pronuba yuccasella* Riley.—Very abundant in the flowers of 'soap-weed' (*Yucca*) as high up on the mountains as 7,000 feet, in the vicinity of Colorado Springs. Mr. Riley says (*Fifth Annual Report Noxious and Beneficial Insects of Missouri*, p. 151), 'Front wings uniformly silvery-white,' but at least half of the numerous specimens observed by me in Colorado had the wings more or less spotted with black (like *Hyponomeuta*, to which in the form and neuration of the wings it seems somewhat allied, though its affinities seem to be rather with the true *Tineidæ;* it is, however, *sui generis*). These spots vary in number from 0 to 13, and when all are present are arranged as follows: one (the largest) at the end of the disk, with three others before it, making a coffin-shaped figure; one on the dorsal margin before the cilia, and eight others around the apex. The one at the end of the cell is found oftener than any of the others, and those around the apex oftener than the other four. The expanse of wings is given by Mr. Riley at 1.00 inch for the ♀ and 0.90 inch for the ♂. The largest ♀ specimen observed by me scarcely exceeded 10 lines and the smallest ♂ was scarcely 6 lines, so that it seems to attain a greater development of wings in the east than in the west, contrary to the rule said by Prof. Baird, Dr. Packard, and others, to prevail among other insects and birds."

"The statements in the above extract are altogether erroneous, being based upon mistaken identity. A careful examination of these supposed spotted Pronubas which I have been permitted to make, through the courtesy of Dr. H. A. Hagen, of Cambridge, Mass., whither Mr. Chambers had sent all his examples, enables me to state positively that the spotted moths which Mr C. mistook for *Pronuba yuccasella* are, in reality, *Hyponomeuta;* and, what is the more remarkable, they are one of Mr. C.'s own described species—*H. 5-punctella.* Of the six specimens submitted to me, there was but one *Pronuba*, and that was immaculate, as the species always is. The spots on *Hyponomeuta* are very variable, while some individuals of *5-punctella* are immaculate, when at first sight they might be mistaken for *Pronuba*. Setting aside the less easily observed venation, this *Hyponomeuta* may at once be distinguished from *Pronuba* by its smaller size, narrower and at the same time less pointed wings, and more pearly-white color. The ♂ differs in the anal hooks, and the ♀ in having the ovipositor of different shape and faintly notched superiorly,* as well as in lacking the characteristic maxillary tentacles.

"I have reared upward of 500 specimens of *Pronuba*, and have it from South Carolina, Texas, California, Colorado, and Missouri, and there is never the faintest tendency to maculation. The tendency to variation is, also, exceptionally small."

We assumed that Mr. Chambers had made a proper reference in describing his *Hyponomeuta 5-punctella*, but we are now perfectly satisfied that he had not, since many specimens of *Prodoxus* agree exactly in maculation with his description and figure. More careful study plainly shows that *Prodoxus* does not even belong to the same family, but must be placed with *Pronuba* in the *Tineidæ*. *Hyponomeuta* not only has, ordinarily, serrate antennæ, but it lacks the maxillary palpi which help to distinguish the Tineidæ, while the joints of the labial palpi are differently proportioned The venation of the wings also differs greatly, the forked disco-longitudinal venlet of the primaries being absent and the basal portion of the internal vein not being forked. The secondaries in *Hyponomeuta* have, moreover, a notch beyond the middle, and there are other minor differences. Mr. Chambers, in reply to our strictures above quoted, has published some 14 pp.* of matter containing many interesting but irrelevant facts, and more that is funny than convincing when it comes to the point at issue. He brings forward no fresh evidence except such as he calls circumstantial, and admits that he does not "pretend that they [the arguments] are conclusive of the question, especially when opposed to the positive statements of so competent an observer," when a careful re-examination of his specimens would have saved him so much fruitless labor. That such re-examination was not, however, easy, we have since been made aware by being ourselves unable to make the re-examination of his supposed spotted Pronubas, the types of which are in the Cambridge museum. Fortunately we are confirmed in our opinion without such re-examination of the types, by the very facts which Mr. Chambers urges in his reply above cited, the position of the five spots in his *Hypono-*

* This faintly notched character of the ovipositor is noticeable exceptionally in both species, and is evidently due to a varied degree of contraction in the dry specimens.

* Jour. Cin. Soc. of Nat. His., Oct., 1878.

meuta 5-punctella, as figured by him, being precisely that found in some specimens of *Prodoxus*. Nevertheless we have not thought best to adopt Mr. Chambers' specific name on our own confidence, because we prefer to leave it to those who substantiate our views beyond peradventure and who believe in the extremest law of priority to relegate *decipiens* as a synonym of 5-*punctella*, and further because we are of those who believe that a description under a well-defined and well-known genus carries with it the characters of that genus, and is worse than no description at all, if as in this instance, the species has totally different characters.

Here is the original description of *Hyponomeuta 5-punctella*, from the *Canadian Entomologist*, vol. vii (1875), p. 7:

Snowy white. On the forewings are five distinct, circular, black spots, three of them forming a line along the middle of the wing, the other two being in the dorsal half of the wing, one of them opposite the space between the first and second, and the other opposite the space between the second and third spots. The first spot is placed about the basal fourth, the second about the middle, and the third about the apical fourth. Hind wings silvery white, tinged with gray. *Al. ex* ¾ inch. Bosque Co. [Tex.]

The number of specimens examined is not stated, so that we learn nothing of variation, and every reader would be justified in assuming that the wings had the peculiar venation and that there was the want of maxillary palpi, with other peculiarities that characterize the genus *Hyponomeuta*. Mr. Chambers subsequently tells us, in his Cincinnati paper, that eight specimens were examined and showed no variation. We made the mistake of trusting in Mr. Chambers' generic reference and of assuming that because his supposed Pronubas were specifically identical with his *H. 5-punctella*, therefore they were *Hyponomeuta*. This mistake on our part would have been avoided had we been allowed to critically examine the specimens by denudation of the wings and other parts; but the specimens were borrowed with the promise that they should be returned to Cambridge intact. We said and we maintain that they were Mr. Chambers' *H. 5-punctella*, and his Cincinnati brochure is really an unintentional criticism of his own previously published views.

In like manner many of the fallacies set forth by Mr. Boll, to which we called attention in our paper read before the St. Louis Academy, may likewise be traced to observations made on *Prodoxus* instead of *Pronuba*.

The larva of *Prodoxus* never quits the stem in which it lives. It eats comparatively little, packing its pale buff-colored excrements very tightly in its burrow, and spinning as winter approaches a neat cocoon of white silk covered on the outside with its castings. Prior to forming its cocoon a passage way is always made to the outside of the stem, leaving but a very thin covering. In issuing, the chrysalis pushes half way out, very much as is the case with all other Lepidopterous endophytes. Oviposition has not yet been observed.

We thus see that, notwithstanding this deceptive resemblance to Pronuba, *Prodoxus* differs not only in many essential characters in its different stages (*vide* description), but likewise essentially in habit.

Who, studying these two species in all their characters and bearing, can fail to conclude that, notwithstanding the essential differences that distinguish them not only specifically but generically, they are derivations from one and the same ancestral form? *Pronuba*, depending for its existence on the pollination of the flower, is profoundly modified in the female sex in adaptation to the peculiar function of pollination. *Prodoxus*, dwelling in the flesh of the fruit or in the flower-stem and not depending upon the fructification of the plant, is not so modified, but has the ordinary characters of the family in both sexes. In the former, the larva quits the capsules and burrows in the ground: it has legs to aid it in its work, while the chrysalis is likewise beautifully modified to adapt it to prying through the ground and mounting to the surface. The latter, on the contrary, never quitting the stem, has no legs in the larva state, and in the chrysalis state is more particularly adapted, by the prominence of

the capital projection, to piercing the slight covering of the stem left ungnawed by the larva. The former is very regular in its appearance as a moth at the time of the flowering of *Yucca filamentosa*, a fact which would indicate that it was modified while living upon that species and had a range co-extensive with it and other species blooming simultaneously. The latter appears earlier, as the food of its larva is earlier ready. Which of the two insects is the oldest in time, or whether the divergence from some archetypal form has been simultaneous, are matters of opinion which those interested in evolution will decide for themselves one way or the other, or according as knowledge increases. That other species of both these genera will yet be discovered, there can be but little doubt.

This Bogus Yucca Moth is subject to the attacks of at least one parasite, a honey-yellow Braconid, which Mr. Cresson considers new, and which is described in this number as *Exothecus prodoxi*.

THE FERTILIZATION OF THE TULIP.

BY W. H. PATTON, WATERBURY, CT.

It has been believed that the nectar of the tulip is poisonous to bees and that they rarely escape from the flower alive. However this may be with the yellow tulip, *Tulipa sylvestris*, in which Kerner (Flowers and their Unbidden Guests, p. 88) has described a special contrivance for excluding *small* insects from the nectar secreted at the bases of the filaments, it cannot apply to our common garden tulip, *T. gesneriana*, for in this species there are neither glands to secrete nectar nor tangles of hairs to protect it, and I have never found nectar in the flowers. It is, moreover, small insects which the plant appears to attract, although the smooth cup of the perianth probably excludes crawling insects. Some of the smaller species of bees of the genus *Halictus* I have, during the past five years, observed to be frequent guests, coming for the pollen. They always alight upon either the perianth or the stigma, most frequently upon the latter, and crawling down from their alighting place to the base of the stamens, they then climb up to reach their booty. Whatever pollen they bring from other flowers has therefore a chance of reaching the stigma first. The perianth of the flower is red, the stigma is yellow and the stamens, which are deeper down in the cup of the flower and thus to a certain extent out of the line of the bee's flight, are black; and it is probable that the marked difference in the color of the stigma serves to attract the bees to the proper and most convenient landing.

There appear to have been no direct observations hitherto made upon the fertilization of the tulip by insects. It may be that in the native home of the plant large insects are concerned in its fertilization, or that *T. sylvestris* thus differs from *T. gesneriana;* but Kerner's supposition that the trichomes on the filaments of *T. sylvestris* are intended to exclude small insects from the nectar, is open to doubt in view of the observations upon the visits of small bees to the other species. A similar structure for protecting the nectar in *Geranium sylvaticum* was believed by Sprengel to serve as a shield against rain, and it may be that this is the real purpose in the tulip. Whether the supposition (of which mention is made in Miss Staveley's "British Insects," p. 250) that the nectar of the tulip is poisonous, is founded upon authenticated facts, is also worthy of further investigation.

TALLOW TO PRESERVE INSECT COLLECTIONS.—The odor of tallow is disagreeable and repellant to a large number of insects, and it has long been the custom to protect woolen goods from the clothes-moth, during the summer months, by placing among them a tallow candle wrapped in paper. For some time past, I have employed the same protective means for the preservation of my entomological collection from the attack of the *Dermestes lardarius* and the *Anthrenus varius*, by placing tallow candles among my cases, and small pieces of the same within the cases. Some inter-

esting experiments recently made with a colony of Dermestes, probably the familiar larder-beetle (see a communication by Miss Heustis in the *Canadian Entomologist*, vol. X, p. 141, 1878), gave the following results :

"They were confined in a glass jar, and a piece of camphor placed therein. At first they manifested some uneasiness, but in a minute or two commenced traveling about and over the camphor with entire unconcern. Upon a small piece of tallow being dropped in the jar, the effect was instantaneous and ludicrous—a regular stampede ensued. The beetles fled precipitately to the side of the jar, and after endeavoring to effect their escape, they huddled together in a mass, where they remained so long as observed. The jar was set aside, and upon looking at it again a fortnight thereafter, only one *dead* beetle was found of the large family. It is presumable that they died soon after their exposure to the tallow, and had eaten up the dead bodies of one another."

A similar experiment instituted by me upon some larvæ of *A. varius*, was not attended by like results. The larvæ did not manifest any uneasiness from the presence of the tallow, nor did they die from the effects of it. While, therefore, I do not believe that the odor of tallow will destroy the larvæ, I have reason to believe that it is serviceable in preventing the deposition of the eggs of Anthrenus, Dermestes and similar pests.—J. A. Lintner.

Intermittance of Phosphorescence in Fire-flies.—There has been an interesting discussion recently at the meetings of the London Entomological Society on this question, some members urging that the light is not intermittent, others again, that it is Mr. McLachlan drew attention to a previous discussion of the same subject, in the course of which he had suggested that the intermittance might be due to "slight currents of air altering the position of the insect when flying, and thus alternately exposing and obscuring the light-producing surfaces." Judging from our experience with North American species of *Lampyridæ*, this explanation is not a valid one All our American species, so far as we know, have the power of extinguishing their light, whether in flight, at rest, or in captivity. In flight there is no simultaneous flashing of all the individuals in a given space, but a constant and irregular flashing and extinguishing. In some cases there is a single flash followed by extinction ; in others, two successive flashes, and in others again, three ; and if pursued, the insect seems to have the power of suppressing its light.

These facts hold true of those species which are luminous, and have power of flight, in both sexes. Where, however, the female has not the power of flight the light is not intermittent, so far as our observations go, and the same holds true of the luminous larvæ of those species which, in the imago state, give out an intermittent light. Yet even these larvæ and larviform females possess the power of suppressing their light, as everyone who has collected them must have experienced to his sorrow. A gem of soft blue light will attract the attention from some distance, in long grass, or damp places, such as these larvæ frequent. The collector approaches cautiously, but, unless he is very wary, so soon as he touches the object upon or near which the light-giving specimen may rest, the light goes out, and the specimen very often escapes being captured !

We call the attention of all those interested in the fertilization of those beautiful flowers, the Yuccas, to our remarks on the True and Bogus Yucca Moths in the present number. It is during the month of June that observations can be made on the habits of these interesting insects, and we shall always be glad to publish additional experience or additional observations.

In the Oefversigt of Finska Vetenskap-Societetens förhandlinger Vol. xxi, 1879, (Helsingfors), Mr. O. M. Reuter gives a synopsis of what is known on the habits of mimetic Hemiptera, together with some new observations on mimicry in this order.

Grain Aphis vs. Rust.—The May crop reports given out by the Department of Agriculture of Georgia, show very clearly how injurious the Grain *Aphis* has been to wheat and oats in that State. These grains have also suffered very much from rust, and many of the correspondents are disposed to consider the rust a consequence of the Aphis work. That the punctures and the saccharine excretions of plant-lice greatly encourage the growth of some kinds of rust, there can be no question whatever. Other kinds, however, as the ordinary Orange rust (*Puccinia graminis*) have little or no connection with these insects. The reports from the Department would be a great deal more valuable if they were analyzed by some competent hand, and the loose general references, which carry no definite meaning, were rendered more specific and explicit.

Continued Destruction of Tobacco Plants by Flea-beetles.—The *Farmers' Home Journal* of Kentucky gives the following account of the continued injury to tobacco, appending many reports in confirmation. We call attention to what we said on p. 123 of the May number:

> There has been a flood of "bug" letters in the last week; and according to the tenor of these advices no portion of the State, or indeed of the entire tobacco belt East or West, is exempt from the evil. Reports from the southern and Green River counties are most unfavorable, but the damage appears to be general, including the Western district, or the Purchase, and also the Mason County district. In some sections of the State a number of farmers have used canvas to cover their plant-beds, and always with the best results, as the covering not only proves to be a complete protection against the bug or fly, but also hastens the growth of plants. In some neighborhoods there is the curious spectacle of uncovered beds entirely stripped of plants, in the immediate vicinity of covered beds full of uninjured and flourishing plants.
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> Advices from Tennessee indicate great destruction of plants, and injuries are also reported from Missouri, Indiana, and Ohio. A Virginia dispatch of the 6th inst. stated that the bugs have so reduced the supply of plants that not more than a quarter of an average area can be planted. The Tennessee Commissioner of Agriculture reports that there will be only half an average supply of plants in that State.

The annual meeting of the Entomological Club of the American Association for the Advancement of Science, will be held at the Museum of the Boston Society of Natural History, corner of Berkeley and Boylston Streets, Boston, commencing at 2 P. M., Tuesday, August 24, 1880.

It is proposed to send to every member of the American Association, and to all others who may favor the undersigned with their address for that purpose, a circular announcing the special subjects which will be presented at this meeting of the Club; and therefore all entomologists who desire to read communications at that time, are requested to notify one of the undersigned before August 1st. This will ensure a fuller discussion of the topics presented, and, it is hoped, a larger attendance.—Samuel H. Scudder, *Pres.*, B. Pickman Mann, *Secretary*, both at Cambridge, Mass.

Mold and Phylloxera.—M. Rommier recently stated before the Paris Academy, that where mycelium was developed on phylloxerized roots, kept in a vessel at 15° to 20° temperature (R.), the insect disappeared, whereas, without such myceleum it continued to multiply. What conclusion of practical value can be drawn from such fact we fail to see, as it must be the experience of everyone who has studied Phylloxera in glass tubes, that those very conditions of excessive warmth and moisture which would permit the growth of mycelium, are the very conditions which would prove fatal to the insect. Any inference that mycelium itself destroys the Phylloxera is certainly unwarranted, if we may judge from our own experience.

An excellent review of the recent progress in insect anatomy is given by Mr. Edward Burgess, in his annual address as president of the Cambridge Entomological Club. Those interested in the subject will find the address in full in the March number of *Psyche*.

INFECTING PHYLLOXERA WITH FUNGUS DISEASE.—The French Academy of Sciences, at its meeting of March 8, 1880, discussed the question of the infection of Phylloxera by parasitic fungi. Mr. A. Giard considers Dr. Hagen's proposed method of infection as impractical. There exists no species of these fungi which infects all insects, each species infects only a single species of insect or a single group, and experiments to inoculate Phylloxera ought to be made with a fungus which is known to affect an allied insect, e. g., with *Micrococa coccophila*. But so far no method is known by which this fungus can be artificially cultivated, as is possible with *Isaria*. Mr. Hamm enumerates the different species of fungi known to infest different species of insects, and proposes to find out, by experiment, whether the Phylloxera is susceptible to the attacks of one of these fungi, then to discover a medium wherein to cultivate its spores; succeeding in this, he would recommend to impregnate guano with the spores and thus bring the Phylloxera in contact with them. Mr. Emile Blanchard has little confidence in the effective destruction of Phylloxera by this remedy, because such destruction of insect life always occurs in nature in a restricted sense, and the Phylloxera cannot possibly be compared in this respect with the Silkworm, which, domesticated for centuries, lives under abnormal conditions.

Riley 1880

FUNGUS IN CICADA.—It has long been known that our Periodical Cicada (*Cicada septemdecim* and *C. tredecim*) is subject to the attacks of a peculiar fungus. The insect is often found with the internal parts, especially of the abdomen, filled with a yellowish, or clay-colored powder, which is in reality composed of spores. Mr. Peck has recently named this fungus *Massospora cycadina*, in the introductory portion to the Thirty-first Report of the New York State Museum of Natural History. Prof. Jos. Leidy referred to this fungus in the Proceedings of the Phila. Ac. Nat. Sc., for 1851 (Vol. v, p. 235), but without naming it

ON THE NATURE OF THE PHOSPHORESCENCE OF THE GLOW-WORM.—In some experimental researches, the results of which have lately been published in the Comptes-rendus of the French Academy, (Vol. 90, No. 7,) Mr. Jousset de Bellesme draws the following conclusions: "It is very probable that the phosphorescent substance is a gaseous product, for the structure of the gland, well studied by Owsjanikof, does not give one the idea of an organ secreting liquid. But chemical phosphorescent products at an ordinary temperature are not numerous, which induces one to believe the substance is phosphoretted hydrogen. It is for chemists to elucidate this point; but they should seek the matter in the cellular protoplasm and not directly.

"My researches induce me to believe phosphorescence a property of protoplasm, consisting in the disengagement of phosphoretted hydrogen. This explains why many of the lower animals, deprived of a nervous system, are phosphorescent. Besides, it offers the advantage of connecting the phenomena of phosphorescence in living beings with that we see in organic matters in a state of decomposition. It is one more example of a phenomenon of the biological order traced to an exclusively chemical cause."

DEATH OF MULES CAUSED BY INSECTS.—The report comes from the Ouachita Valley, Louisiana, that great numbers of a "poisonous midge" made their appearance, attacking the mules to such an extent that in Ouachita, Caldwell, and Morehouse parishes alone, about 6,000 mules perished as a consequence. The insects disappeared as suddenly as they came. The "poisonous" midge alluded to is, without doubt, a species of *Simulium*, but whether or not the report is exaggerated we have no means of knowing.

May-beetles have been swarming to an unusual extent on the oaks around Mobile, Ala., during the past month, absolutely defoliating the oak forests.

Fungus Diseases of Beneficial Insects.—Messrs. Ch. Brogniart and Max. Cornu, in a note addressed to the French Academy of Sciences, communicate that they observed an epidemic in Syrphus-flies caused by a fungus belonging to the genus *Entomophthora*. They found on blades of grass thousands of dead specimens of *Syrphus mellinus* with the abdomen distended and greasy, and evidently killed by the same disease which affects our common House-fly. The larvæ of our Syrphus-flies are among the most effective enemies to Plant-lice. It thus becomes apparent that our friends among the insects are fully as liable to fungus disease as are our foes. Even if the fly-fungus could be propagated at will by the use of beer-mash, and made to infect other kinds of insects, no matter how diversified their habits (a fact which we have good reason for being sceptical of), there would yet be danger of destroying many beneficial with the noxious species. This objection, however, applies, in varying degree, to almost all insecticides.

Early Appearance of Cotton Worm.—Mr. J. M. Bell, of Boxville, Lavaca Co., Tex., writes, April 29th, 1880:

> There are cotton worms in my cotton—more than usual when they first appear. There is no doubt about their being genuine cotton worms.
> We had a tremendous rain this morning.

The Goliad (Tex.) *Guard* of May 8th has the following:

> We made a short turn in the country last Monday, and saw several farms on the Mannahuilla and Perdido creeks, which were in excellent condition. Corn and cotton were doing well, but we were sorry to learn from Mr. L. H. Dreier, a very successful planter on the Perdido, that the worms had already attacked his cotton. His neighbor, Mr. Hausman, whose cotton was well advanced and very fine, was also visited by large numbers of these pests.

The presumption in such instances is that the worms were in the field from two to three weeks before being reported. Mr. Geo. Witting sent us, the latter part of April, information that the worms were noticed in the vicinity of Columbus, Tex., and specimens received at Washington, the forepart of May, were all in the chrysalis state.

The Butterfly Tongue.—Mr. Edward Burgess has an excellent, and well illustrated article in the May number of the *American Naturalist*, on the structure and action of the proboscis, or tongue, of butterflies. He comes to the following conclusions from his study of the subject:

> From the anatomy of these parts we may understand that the butterfly obtains its food in the following manner: The trunk is unrolled and inserted in the nectary of a flower; at this moment the muscles which suspend the oval sack contract, and the mouth cavity is thus extended, creating a vacuum which must be supplied by a flow of honey through its trunk to the mouth. When the mouth is full the muscular sack contracts, the oval valve closes the aperture to the trunk, and the honey is forced backward into the œsophagus. The mouth cavity is then again opened and the same process repeated. To prevent the food being sucked back from the œsophagus, it is probable that some of the numerous fibers in the muscular sack, near the origin of the former, can, by contraction, close its opening, but in any case, as the trunk presents a free tube, and the œsophagus leads into the closed alimentary canal, it is evident that the former offers the easiest route for a supply to fill the mouth vacuum.
>
> In the muscular mouth sack, we have a pumping organ, of action too simple to be misunderstood. As for the so called "sucking stomach," its delicate membranous structure is certainly not adapted for sucking functions, and it probably serves only as a reservoir. It is usually found to contain nothing else than air, but Newport asserts, that immediately after feeding, food is also found in it.

Cottony Maple Scale.—In the Proceedings of the Davenport Academy of Natural Sciences, vol. ii, part 2, just received, Mr. J. D. Putnam gives a most valuable, painstaking, and thorough account of the above-named insect (*Pulvinaria innumerabilis* Rathvon), which has proved very injurious to the soft maples in various parts of the country, and particularly in and around Davenport. He goes into details on the history; the egg; embryo; larva; larva of the second stage; development of the male pupa; the male; development of the female pupa; the female; the female in winter; the female in spring; contents of the ovaries; development of the egg; fertilization of the egg; the laying of the egg; the egg; nest; last days of the female; diseases; parasites; enemies; manner of distribution; effect on the trees; remedies; food-plants; and other species of *Pulvinaria*.

Necrological.—News comes to us from Europe of the death of three eminent entomologists. Ernest August Helmuth von Kiesenwetter, born in 1820, was a member of the Saxon Privy Council. Most of his writings appeared in the *Stettiner Entomologische Zeitung* and the *Berliner Entomologische Zeitschrift*, and they are quite numerous, but exclusively on Coleoptera. S. C. Snellen van Vollenhoven was born in Rotterdam, October 18, 1816, and in his death Holland has lost her most eminent entomologist. For many years director of the Natural History Museum at Leyden, he was so esteemed and respected, that a medal was struck in his honor upon the occasion of his retirement. He wrote mostly upon Hymenoptera, and his work upon the Dutch Saw-flies has no equal. His writings were beautifully illustrated with drawings from his own pencil. Francis F. de Laporte, Count of Castelnau, was born in London, December 25, 1810, and died February 4, 1880, at East Melbourne, Aust., where he was for many years French Consul. He spent some time in the United States, and gave some attention to American insects. He wrote more particularly on Coleoptera and Hemiptera, and among his miscellaneous works were *Vues et Souvenirs de l'Amérique du Nord*, and *Essai sur le système silurien de l'Amérique septentrionale.*

Effects of Severe Cold on Insects.—A very general impression prevails that severe winters are prejudicial to insect life. It is, however, a quite erroneous impression, for nothing has struck us so forcibly in our experience with injurious insects, as the fact that in most cases they pass more safely through a steady, even if severe winter, than through a mild or changeable one.

We have repeatedly called attention to this fact in our own writings, and Miss E. A. Ormerod, in her *Notes of Observations on Injurious Insects*, for 1879, has some quite pointed remarks on this subject, in connection with the severity of the past winter in England.

Severe and steady cold is not only favorable to insect hibernation by causing a continued state of torpor, but indirectly in preserving them from the attacks of birds and other animals, which, during such severe weather, cannot reach them in the frost-bound ground. Mild winters, on the contrary, generally cause premature activity in insects, often followed by relapses into the torpid state, and such changes are prejudicial to their well-being. Insectivorous animals also fare better during such mild winters.

Exchanges with European Entomologists.—We receive frequently from European Entomologists communications offering exchanges of insects of different orders, and especially of Coleoptera. As we cannot ourselves accept any of these offers, for want of time, we would like to have addresses of those of our collectors and specialists who are willing to enter into correspondence and exchange with European entomologists.

Mr. T. Blackburn of Honolulu communicates that *Vanessa cardui* appeared quite frequently in the year 1879, on the island of Hawaii, during the month of February till July. He never before observed the species on the island mentioned above.

Revision of the Lampyridæ.—Mr. Henry S. Gorham of Shipley, Horsham, England, is just completing a revision of the *Lampyridæ*, or Fire-flies, and desires specimens from the southern part of the U. S., and from Central America, especially of the genera *Microphotus*, *Phengodes*, and *Pterotus*. Our own Dr. LeConte has, as we understand, been at work on the same family, and has the manuscript of a revision of the *Lampyridæ* of the U. S. ready for publication.

Errata.—Page 80, for "[Fig. 19]" read [Fig. 20, *a*]; page 81, for "[Fig. 20]" read [Fig. 20, *b*]; page 122, col. 2, line 23, for "shows" read "show."

On Our Table.

The Crayfish: An Introduction to the Study of Zoölogy. By T. H. Huxley, F R.S. 8vo., pp. 371, 82 illustrations. D. Appleton & Co., New York, 1880.—Prof. Huxley is "the man of men" most competent to write the life-history of an animal in all its aspects, and in this work, whose title very inadequately expresses its scope or importance, we have a model study in zoölogy. "I have desired to show how the careful study of one of the commonest and most insignificant of animals leads us, step by step, from everyday knowledge to the widest generalizations and the most difficult problems of zoölogy, and, indeed, of biological science in general." So says Prof. Huxley in his preface, and so he leads his reader, from natural history, to the results of the latest researches in physiology, morphology, distribution and ætiology; defining and comparing with his wonted clearness and conciseness; discussing and solving, to the limits of present science, the general problems which claim the attention of the zoölogist. A book invaluable to students and instructors.

Darwinism and other Essays. By John Fiske, A.M., LL.B. 8vo., pp. 283. Macmillan & Co., London and New York, 1879. Price, $2.00.—Here are brought together in convenient form various essays and reviews hitherto scattered through periodicals, and the collection is a valuable and welcome addition to the literature of evolution. Darwinism has suffered not a little at the hands of some of its most ardent champions, and, in the words of Mr. Huxley, "Many a spirited free-thinker makes use of his freedom mainly to vent nonsense." Mr. Fiske is a more wise and moderate advocate. His essays may be strongly commended to all interested in the study of contemporary thought; nor are they less calculated to interest the general reader than to help the student. They are full of valuable thought, and their topics are rendered enjoyable even to the unproficient. They will be found especially useful and instructive to those who are perplexed with conflicting views anent the doctrines of evolution. We lay Mr. Fiske's book aside feeling, as its author says at the close of one of his essays: "That yet another charming moment of our reading life has gone to be numbered with the things of the past."

The Taxidermists' Manual, by Capt. Thomas Brown, F. L. S. Twenty-eighth edition. New York. G. P. Putnam's Sons.—Persons who take an interest in natural history frequently meet with objects that they would gladly preserve if they possessed the knowledge requisite for the purpose. The present volume is designed expressly as a guide to those who may desire information in regard to preserving the various objects of natural history in all countries and climates. The work is fully illustrated, and published as one of Putnam's Popular Series of Instructive Manuals, and one that will prove valuable to the naturalist while laboring in the field or cabinet.

Classification and Description of the American Species of Characeæ. By D. B. Halsted. 8vo. pp. 22. (Ext. from Proc. Boston Soc. Nat. Hist., Vol. XX, March 5, 1879.) From the Author.

Memoirs of the Science Department, University of Tokio, Japan. Vol I, Part 1: Shell Mounds of Omori. By Edward S. Morse. 4to. pp. 36. 18 Plates. Tokio, Japan, 1879. From the University.

Neue Beobachtungen und Entdeckungen an den auf Ulmus campestris L. vorkommenden Aphiden-Arten. Von Dr. Hermann Friedrich Kessler. 8vo. pp. 34. 2 Plates. Cassel, 1880. From the Author.

Commission Supérieure du Phylloxera. Session de 1879. Compte rendu et pièces annexes. Loi, decréts et arrêtés relatifs au Phylloxera. 8vo. pp. 66. 1 Map. Paris, 1880.

Proceedings of the American Philosophical Society. Vol. XVIII, No. 105, January to March, 1880. Philadelphia. From the Society.

Annual Reports of the Nebraska State Board of Agriculture, and the State Horticultural Society, to September, 1879. 8vo. pp. 350. 1 Map. Lincoln, Neb., 1880. From the Secretary.

Proceedings of the Poughkeepsie Society of Natural Science, from October, 1878, to July, 1879. 8vo. pp. 54. 4 Plates.

Some Interesting New Diptera. By S. W. Williston. 8vo. pp. 4. (Ext. from Trans. of Connecticut Academy. Vol. IV, Part 2, 1880.) From the Author.

Proceedings of the Western New York Horticultural Society. Twenty-fifth Annual Meeting. Rochester, Jan. 28 and 29, 1880. 8vo. pp. 154. From the Secretary.

Johns Hopkins University. Studies from the Biological Laboratory. No. IV. The Development of the American Oyster. By W. K. Brooks. 8vo. pp. 116. XI plates. Baltimore, 1880. From the Author.

Las Vides Americanas y La Filoxera en España. Revista publicada por J. Muñoz del Castillo. Año 1, No. 6. Diciembre, 1879. Logroño. From the Publisher.

Sur la Nymphe du genre d Éphémérines Bætisca, par Benj. D. Walsh, M. A. Traduit de l' Anglais et Annoté par Le Dr. Émile Joly. 8vo. pp. 19. Angers, 1880. From the Author.

Extracts from Correspondence.

[We shall publish in this Department such extracts from the letters of our correspondents as contain entomological facts worthy to be recorded, on account either of their scientific or of their practical importance. We hope our readers will contribute each their several mites towards the general fund; and in case they are not perfectly certain of the names of the insects, the peculiarities of which are to be mentioned, will send specimens along in order that each species may be duly identified.]

Odontota scutellaris, Oliv., bad on a variety of trees.—On the 7th May—not a locust leaf or flower to be seen, a few buds only, bursting, I observed the terrible enemy of the *Robinia*. They came in great numbers and were devouring the advanced foliage of Siberian Crab-apples, rendering them quite shabby—other apples close by, and suckers from the stocks upon which they were grafted, escaped. In the wild woods the tender leaves of *Ulmus americana*, White-elm, were eaten, those of *Ulmus fulva*, equally abundant, escaped. The *Cratægus tomentosa* and some quinces appeared eroded in the same manner, but the insect was not seen. I wrote you last summer that these beetles, on emerging from their pupæ in the mined leaflets of the *Robinia*, at once began feeding upon what green leaves were left, but finding insufficient food, or having had narrow pastures as larvæ, their appetites were voracious, and they had attacked the young leaves of Red-oak (*Q. rubra*). This tree has again furnished them abundant food in the emergency of the late vernation of *Robinia*. The *Q. coccinnea*, *castanea*, *prinos*, *palustris*, *macrocarpa*, *phillos*, *lyrata*, *imbricaria*, etc., close by have escaped, nor has it been seen on the *Q. alba*, rare here; but it has raided a favorite tree of the European White-oak, *Q. pedunculata*—nor have the trees of *Q. palustris* (of the Red-oak class) been affected, though surrounded by Locust trees. These tastes of the *scutellaris* are very singular.

Apple-twig Borer.—*A. S. H., Wytheville, Va.*—The insects which you send accompanied by an apple-twig, showing their work, and which are so destructive to your Apple trees, are the well-known Apple-twig borer, of which you will find an account, with figures, on p. 51 of this Magazine.

Insect Powders.—On running over the pages of your Bulletin on the Cotton Worm I notice that you have something to say about Pyrethrum Powder, which reminds me that Dalmatian Insect Powder is, according to some authorities, made from the *Leucanthemum vulgare*, our Ox-eye daisy. In Europe it is called *Chrysanthemum Leucanthemum*. Could we not so utilize that vile weed? I think the subject is worthy of experiment. The Dalmatian is said to be equally as good as the Persian Insect Powder.—William Saunders, Washington, D. C.

Cotton Culture and the Cotton Worm at Manzanillo, Mexico.—The larger worm or caterpillar (*Anomis xylina*) has made its appearance on this coast three times during the last 20 years; in 1866, in 1873, and again in 1878. It is a dark green looping worm, with white and black lines, and destroys the cotton plant by devouring the leaves. It is as yet impossible for me to find out the origin or even habits of this worm. I have investigated the supposed causes of its appearance, but without success; the farmers here have not the slightest idea about it. An apparent coincidence between the appearance of this plague and overflooding of rivers in the cotton regions should be mentioned.

1865, September, high floods, complete inundation of cotton lands. February, 1866, appearance of the caterpillar in small numbers, not causing much damage.

1872, September, floods, partial inundation of cotton lands, high lands and ridges in the valleys not flooded. February, 1873, appearance of the plague, and total destruction of cotton plantations.

1878, September, high floods, complete inundation of cotton-growing valleys. 1879, February, partial plague, small damage done by the caterpillar.

I am of the opinion that the worm has not been imported into Mexico, but originates in the cotton valleys in such seasons, when the peculiar condition of the soil and climate combine to favor the development of the larva.

The cotton lands in this vicinity are bounded on the W. by the Pacific Ocean, on the E. by high mountains, la "Sierra Madre," on the N. and S. by dense woods and tracts of uncultivated lands. These circumstances present a great many obstacles to the flight of the Cotton Moth. The nearest cotton plantations, as well to northward as to southward, are at a distance from Manzanillo of at least 100 miles.

Cotton has been grown in the State of Colima for the last fifty years. It does not grow wild, but if abandoned, some plants grow up to good sized trees, bearing fruit regularly every year.

The directions of prevailing winds, on this coast, are the following, viz:

January,	South and West.	
February,	West and North-west.	
March,	do	do
April,	North-west.	
May,	do	
June,	South and North-west.	
July,	South and West.	
August,	do	do
September,	do	do
October,	do	do
November,	do	do
December,	do	do

The north-west and west winds blow generally during the day. At night these winds change to the north, and north-east.

I give the prevailing winds for the whole year, as our planting and picking seasons here are different from those in the United States.—Augustus Morrill, U. S. Consul at Manzanillo, Mex.

Antigaster mirabilis in Florida.—I was perfectly delighted with the different insects described in the report you sent me. The parasitic fly (*Antigaster mirabilis*) was intensely interesting, as I had myself raised it from the eggs of *Microcentris retinervis*, and have had no trouble in identifying it from your admirable cut.

The *Aphelinus*, named and described by me in *Canadian Entomologist*, resembles the cut of *A. mytilaspidis*, only its abdomen is more slender and the thorax is not so thick.—Wm. N. Ashmead, Jacksonville, Fla.

Capture of Cotton Moth in January.—I beg to inform you that in a conversation with James Seymour, one of our most energetic, and largest cotton planters, he informed me that he caught, about the 20th of January last, a fully developed Cotton Moth.

The general impression among planters and farmers is that we shall have the worms very early this season, as the winter has been very mild. We had considerable rain; the month of January was warm, also part of February, so that many people planted corn and cotton, in this section of country, which was well up and forward, but was destroyed by frost in March.—Geo. Witting, Columbus, Tex., Apr. 16.

[Mr. Seymour, whose acquaintance we had the pleasure of making, would not be likely to make any mistake in his determination.]

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Grape-vine Flea-beetle.—I take the liberty to address you in the hope that you will be so kind as to suggest some remedy against the inclosed (pests) insects that have attacked part of my vines. I noticed them last year for the first time on one vine only, but I was not fully aware of their destructive powers. This year many more have appeared and have spread to many vines. They destroy the buds when they first swell, by boring or eating the inside of them.

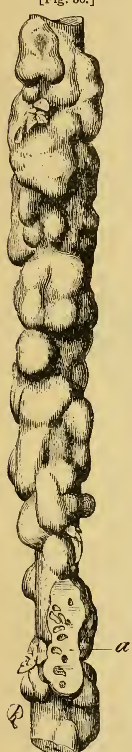
I presume the larva should be hunted and destroyed, but I am ignorant of its hiding-place and appearance. By giving me some information on this subject, you will confer a great favor.—J. Nilis, Dingman's Ferry, Pa.

The insect sent is the Grape-vine Flea-beetle,

and so much complaint has been made of it this spring that we shall publish an account of it in the next number, for the appearance of which we beg our correspondent to wait.

Cynipid gall on Oak Twigs.—*J. A. W., North Bend, Ohio.*—The gall which you send on the twigs of *Quercus castanea* is new to our cabinet and evidently new to science, and if we find this to be the case upon further inquiry, we will briefly describe it in these columns. It has some resemblance to that of *C. quercus-punctata* Bassett, which is found on *Q. rubra.* This last, however, is a much larger, more rounded and less elongate swelling, the diameter being 4 or 5 times that of the twig. The flies bred from these galls, so far, always issue in the spring and are uni-sexual, all of them being females, and there is little doubt from our present knowledge of dimorphism in these insects, that there is a bi-sexual form producing probably a totally different gall perhaps on some other part of the tree, as the bud or leaf. We should be very much pleased to have you watch the trees from which these galls were taken and send us whatever gall growths may be noticed thereon during spring and early summer, as we may thus get at the real connection between this and some other gall. Your gall, which we illustrate (fig. 56), is also very near to *C. g-batata* Bassett.

[Fig. 56.]



CYNIPS GALL on twig of *Quercus castanea* (after Riley).

The very close resemblance of many of the species producing stem swellings on our oaks renders their specific determination difficult, and we never shall understand the true specific relation many of the Cynipidæ bear to each other until they have been properly studied in their dimorphic forms, and this can only be done by careful breeding, and this only by confining the uni-sexual flies to growing twigs in fine muslin bags. We note what you say about these galls always being confined to young, thrifty trees.

White Grub Fungus.—I inclose you what I suppose to be an ordinary Grub-worm with a vegetable sprout growing from its head, and would be pleased to have you examine it and let me know what it is.

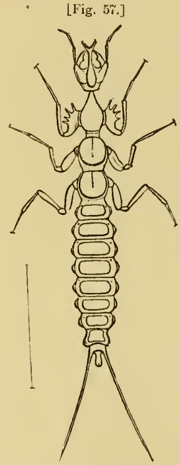
A few days ago I had some teams plowing, and my little son, following them for the purpose of finding fish-bait, found and brought me two of these worms with a sprout about one inch long growing from each side of the head, apparently from the eyes. I planted them in a pot and set it in our window. When I put them in the pot the sprouts were about the size and length of the inclosed specimens, and white in color; but on examination several days after planting, I found that they had grown to about the size of an ordinary wheat straw, and increased considerably in length, and turned from their white color to a deep red, the worm remaining the same as when found.

All I have found were in one locality, on a gravelly point of prairie land that was broken for the first time last year.—H. S., Iola, Kan.

You will find the fungus fully treated of in this number.

Galerita janus.—*H. D. M. Fair, New York, N. Y.*—The beetle you send belongs to the Ground-beetles (*Carabidæ*) and is known as *Galerita janus* Fabr. It is widely distributed in the United States east of the Rocky Mountains, commonly occurring under stones, logs, etc., in the more northern States, but less frequently in the South. The larva (Fig. 57, that of an allied species, *G. Lecontei* Dej. from Packard's *Guide*) is to be found in the wood under old leaves in somewhat damp localities and is, like the perfect insect, nocturnal in its habits. Both larva and imago are frequently attracted to sugared trees. About the beginning of August the larva retires in some old rotten log to undergo its transformation. The imago hatches a fortnight later and hibernates in the ground to reappear with the first warm days of spring. In the Southern States this insect has probably two annual generations, as full grown larvæ and pupæ are found in May.

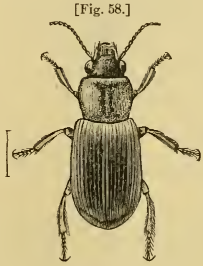
[Fig. 57.]



GALERITA LARVA (after Packard.)

Not Fuller's Rose-beetle.—*John Stewart, Dickson City, Pa.*—The beetle which you send, and which you suppose may be the Rose-beetle (*Aramigus fulleri*) has in reality no connection with that insect. It is known to entomologists by the name of *Agonoderus comma* Fabr., and belongs to a family of predaceous beetles. Very little is known of the habits of this genus of beetles, beyond the fact that they usually swarm on warm days of spring and summer. This species is now regarded as identical with *Agonoderus dorsalis* Lec., and for the benefit of the rest of our subscribers we reproduce a figure of it from the 1st Report of the U. S. Entomological Commission, in which it was reported as swarming in fields infested with

[Fig. 58.]



AGONODERUS COMMA.

the eggs of the Rocky Mountain Locust, and evidently preying upon said eggs.

This species is so closely allied to *A. pallipes* Dej., that we do not believe the two should be considered distinct. The following characters are supposed by coleopterists to distinguish them: In *A. comma* the hind angles of thorax are almost rounded, the scutellar stria long, and the black color extends to the base of the elytra; in *A. pallipes* the thorax is less narrowed behind, the hind angles more distinct, though obtuse, the scutellar stria is very short and the black color does not reach the base of the elytra. When abundant material is examined these differences are seen to so graduate that they should be considered varietal rather than specific.*

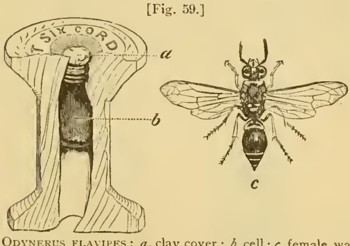
Not Aletia Chrysalides.—I send you by this mail a match-box containing eight chrysalides, taken from the ground by my hands in chopping cotton. Our fields were all stripped by the worms last August, and for several weeks the naked stalks were ornamented by their chrysalides, pendant from limb and bough. I suppose these are the same, but you can judge of that when the moth comes out, as they are full of vitality.

The field from which the inclosed were taken, was broken up the 1st week in January. They are plentiful wherever cotton was planted last year. Have not yet discovered any in the fields where corn was planted last year. Would like to know if the specimens develop our peculiar enemy.—Geo. P. White, Brown Station, Ala., May 4 1880.

The chrysalides sent by our correspondent are not those of *Aletia*. They will produce a dark gray moth known as *Agrotis inermis* Han. (*saucia* Hübn.) and which was fully figured and described by us in 1868, in our 1st Report on the Insects of Missouri. The larva is one of the common cutworms that injure cotton in the spring of the year. You may rest assured that no chrysalis that is dug up from the ground will be that of the Cotton Moth.

Mud-wasp and Parasite.—*M. T., Vineland, N. J.*—The Mud-wasp you send, reared from a series of cells agglomerated round a twig, is *Odynerus birenimaculatus* Sauss., a species allied to *O. flavipes* Fabr., which we represent in Fig. 59. The parasite bred therefrom is *Cryptus junceus* Cress. (*vide* Fig. 60). This parasite infests also other Mud-wasps, *e. g.* those belonging to the genus *Agenia*. Your wasp uses small Lepidopterous larvæ, such as those belonging to the leaf-rollers (*Tortricidæ*) wherewith to store its nest, first paralyzing them as is usual with the insects of its family. In the case of the specimen from which our illustration was made the wasp built in the hole of an old cotton-spool, making two cells and closing up each end of the hole in the spool with clay. Other species of the genus *Odynerus* build either in wood that has been bored by other larvæ, or in the interstices of walls, while one species (*conformis* Sauss.) which we find commonly around Washington makes use of the burrows of a mason-bee (*Melissodes taurea* Say).

[Fig. 59.]



ODYNERUS FLAVIPES: *a*, clay cover; *b*, cell; *c*, female wasp (after Riley.)

[Fig. 60.]

CRYPTUS JUNCEUS, twice nat. size (after Riley).

Monographs again.—Will you please inform me through the columns of the AMERICAN ENTOMOLOGIST, whether there are Monographs of the *Elateridæ*, *Curculionidæ*, and *Coccidæ* by which species can be determined?

Also, to whom shall I address myself to obtain the government publications on the subject of entomology? I am so unfortunate as to have no friends in congress to assist me in obtaining them.—C. D. M., Leicester, Mass.

A revision of the *Elateridæ* of the United States was published by Dr. LeConte in the Transactions of the Amer. Phil. Soc., vol. x, 1853, but since that time many additional species have been described. The publication of a monograph of this family, in several volumes, by Candèze, was began in 1857, and an appendix to this work entitled *Revision de la Monographie des Elaterides* has recently been added by the same author. In *Curculionidæ* we have now the admirable monograph of our North American species by Drs. LeConte and Horn, published in the Proceedings of the Amer. Philos. Soc., vol. xv. For the determination of foreign species of this

* Having requested Dr. G. H. Horn's opinion on the abov subject, he writes: "In reply to your query as to *Agonoderus pallipes* and *comma*, I will say that I have always considered the two the same. I do not find the differences in the hind angles and the scutellar stria constant, *i. e.* they are not always concurrent. I am also willing to go a step further and add *rugicollis* to the synonymy.

family you have to recur to Schoenherr's *Genera et Species Curculionidum*, a work which has, however, been superseded in many parts by more recent revisions of numerous genera and subfamilies published mostly in various European periodicals.

There is no work on American *Coccidæ*, and only a few species have been treated of separately by Harris, Fitch, Walsh, and ourselves. The most complete work on this family is that by V. Signoret, in the *Annales de la Société Ent. de France.*

The government publications on the subject of entomology may be obtained by applying for them to the different Departments under whose auspices they are issued. Those of the Smithsonian Institution are to be had for sale through the Institution.

Rearing Wood Borers.—Can you give in the correspondence column of your valuable magazine information as to the most reliable method of rearing larvæ living under the bark or in the wood of trees. I have seen recommended jars of sawdust, but wish to inquire whether the sawdust should be *moist* or *dry*, and whether the jars should be kept closely sealed or not. As I have frequent opportunities of obtaining larvæ, and take much interest in the study of *Buprestidæ* and *Cerambycidæ*, etc., any information you can give will be of much value, not only to myself, but to many others, for I know that much difficulty is experienced in successfully rearing such larvæ.—W. Hague Harrington, Ottawa, Can.

The most important rule in raising larvæ that live in wood or under bark is to give them in captivity, as far as possible, the same conditions under which they naturally live. They should be handled as little as possible, and if their burrows be split open the wood should be tightly bound together again with fine wire. Larvæ living in dry twigs or dry wood are easily raised by putting the twigs in a glass jar, or in any cage. Those dwelling in live wood are much more difficult to manage, and there is little hope of rearing them if they are brought in-doors too young. The difficulty in rearing larvæ that live in green wood or under moist bark is due to the impossibility of providing them with the right degree of moisture without inducing mold. Our own experience is adverse to the use of sawdust, the difficulty before alluded to being increased by the use of this substance, which adheres to the larvæ and gives them no chance of making a clean burrow. The best way is to watch the infested trees till the larvæ are full grown or in the pupa state, then take a few home for confinement, and leave others out-doors, under natural conditions, in case of failure in-doors. We have had very good luck by boxing up in tin, sections of a branch or trunk infested with boring larvæ. The tight tin box prevents too rapid desiccation, and secures the beetles when they cut their way out of the wood.

DESCRIPTIVE DEPARTMENT.

ON A NEW TINEID GENUS ALLIED TO PRONUBA, Riley.

BY C. V. RILEY.

PRODOXUS,* NOV. GENUS.

Agreeing in all respects with *Pronuba* except in the following important particulars: the basal joint of the maxillary palpi in the ♀ is not produced into a spinous tentacle, but is formed just as in the ♂, being a mere, blunt-pointed tubercle.

Larva apodous.

Prodoxus decipiens, n. sp.—♀, Average expanse only 16^{mm}. It has all the characters of *Pronuba yuccasella* except in lacking the maxillary tentacles; in the smaller average size; in the abdomen being less drawn out, but more pointed at tip; the ovipositor not exposed and probably not exsertile, whereas in *Pronuba* the tip of the abdomen is slightly thickened, and the ovipositor readily issues from the truncate end. Colors as in *Pronuba*, except that the ordinary immaculate white of primaries above may be variously spotted, the number of spots ranging from 1 to 5, or more† usually arranged along the middle in the form of a broad W—a dot representing each angle and each outer tip. When the basal spot alone is absent the four remaining present the figure of a rhomboid; when it is absent and there is another spot posteriorly, we have the W inverted, but there is no constancy in the relative positions. When a single spot is present there is no regularity in its position, and it may be differently placed on the two opposing wings of the same specimen. There may also be more spots on one wing than on the opposite one, while the thorax is distinctly spotted in one of my specimens, there being two metathoracic, mesial spots, one above the other.

♂, Average expanse about 1^{mm} less than ♀. Distinguished from *Pronuba* in the sculpture of the genitalia and in their being much more elongate and prominent. The clasps extend fully twice as far, are less recurved and have on the lower border 4 small black points or tubercles, nearly equidistant from each other, instead of a single larger point as in *Pronuba*.

Described from 25 specimens, either taken in 1873 from Yucca flowers at Bluffton, S. C., or

* πρόδοξος, judging of a thing prior to experience.

† If the specimens taken from Yucca in Colorado by Mr. Chambers and referred to *Pronuba* are, as we feel convinced they are (see remarks on page 143 of this number), the *Prodoxus* in question, then the black spots may be more numerous than we have observed, since he found them to vary from 0 to 13. Those additional to the five above referred to are placed around the hind border. In his figures illustrating the spots on his *H. 5-punctella* and his spotted *Pronubas*, we believe Mr. C. has been unfortunate in getting specimens with the basal spot obsolete, in which event the number of spots on each wing may reach 14. At any rate, so far as those figures imply constancy in position of spots, they are erroneous and misleading, and do not accurately illustrate either his own specimens, which I have seen, or the commoner forms which I have reared. Nor are there any essential differences in the roughness of the hair on the vertex, or in the length or scaliness of the antennæ, between *Pronuba* and *Prodoxus*, as Mr. C. intimates on the last page of his brochure. The antennæ in both are very apt to be naked toward tip, and sometimes nearly the whole length, the scales upon them being very loose.

subsequently reared from the flower-stem of Yucca. The variation in size is considerable, exceptional ♀ ♀'s expanding to 24^{mm}. The spots on the wings are sometimes so small as to be confined to a single scale, while the primaries are sometimes perceptibly more acuminate with the white of wings usually more silvery, less creamy than in *Pronuba*, with the dark shades, as of the eyes, and the dark hairs on the palpi, front legs, tarsi, and at base of costa on primaries more pronounced and blackish.

Larva.—Length from 5 to 7^{mm}. Perfectly apodous, plump, broadest on joints 2 and 3, tapering thence posteriorly, with the dorsum strongly arched and the head and prothoracic joint more or less fully bent down on the breast. The body is glabrous and not conspicuously wrinkled. Head small, retractile. Stigmata placed as in *Pronuba*, *i. e.*, the first pair on the hind portion of the prothorax and rather lower down than the succeeding 8 pairs which are on the anterior portion of joints 4 to 11, the prothoracic spiracles somewhat larger than the rest. Color of body either pale yellowish-white, or emerald-green, this last being the more usual color of the mature and especially of the hibernating specimens. The head is honey-yellow with a dusky spot on each side, a dash on each suture of the epistoma, the mouth dark brown, the mandibles black, labium and maxillæ white; the mandibles have four teeth, much blunter than in *Pronuba*, as compared with which they (the mandibles) are more prominent. All the other trophi and the ocelli are as in *Pronuba*, though the labial palpi are smaller and more plump and the labium and maxillæ do not surpass the mandibles. The cervical shield is not defined as in *Pronuba*, but consists of 4 chitinous patches of the same color as the head.

Chrysalis.—Average length about 6^{mm}. Of the same color as in *Pronuba* but much more slender, with the dorsum less arched and lacking the characteristic dorsal, arcuated plates with their peculiar recurved, flattened spines, there being in place of them the barest indication of a transverse row of minute points or teeth near the anterior border of joints 6–11, joint 5 which is so strongly armed in *Pronuba*, being here perfectly smooth. Joint 12 in both sexes is unarmed as in ♂ but not in the ♀ *Pronuba*,* while the terminal subjoint is much swollen and curved upward, with two minute spines taking the place of the broader, compressed processes in *Pronuba*. The sexes are only distinguishable by the somewhat less swollen subjoint in the ♀ and her longer leg-sheaths, which reach a little beyond the tip of body, whereas in the ♂ they fall short of the tip.

* I have already pointed out (Trans. St. Louis Ac. Sc. iii, p. 178) that the sexes may be infallibly distinguished in *Pronuba* in the chrysalis state. The two broad terminal processes in ♀ are from joint 12, whereas in the ♂ they really belong to the anal subjoint, so that there is in the ♂ a greater distance between them and the preceding row of spines than in the ♀.

A NOTE ON MELISSODES NIGRIPES.

BY W. H. PATTON, WATERBURY, CT.

There has been a strange confusion in regard to the sexes of *Melissodes desponsa* Sm. and *Synhalonia atriventris* (*M. atriventris* Sm.). The latter species is of interest as being the only northern member of the genus occurring in Connecticut and other northern States. Smith described a ♀ under the name *M. desponsa*, a ♂ under the name *M. atriventris*, and both ♂ and ♀ under the name *M. nigripes*. But unfortunately his ♂ of *nigripes* is in reality that sex of *desponsa* and his ♀ of *nigripes* belongs to *atriventris;* this can be at once seen by anyone having specimens and the descriptions before him, the two sexes described as *nigripes* belonging to distinct genera. I have often taken the two sexes of *desponsa* together in August upon the thistle-heads; the habits of *atriventris* must be different, as that species, like others of its genus, flies in spring. The confusion has been made complete by Mr. Cresson in his recent *Catalogue of North American Apidæ*, where *atriventris* is quoted as a synonym of *desponsa*, again a union of species generically distinct. This being the case and the date of publication of the three names being the same, it seems best to drop "*M. nigripes*" entirely. The form with fuscous wings which Smith describes as a variety of *M. desponsa* does certainly not belong to that species, but appears to be *M. bimaculata* (Lepel.) Cress., a species which Smith did not identify.

A PARASITE ON PRODOXUS DECIPIENS.

BY C. V. RILEY.

Exothecus prodoxi n. sp.—Average length, exclusive of ovipositor, 3.3^{mm}; expanse, 5.6^{mm}. Color, dark honey-yellow; abdomen toward the tip a little paler; antennæ with the terminal half, black or blackish; mesosternum, yellowish-white, sometimes a little darker at middle; legs, pale yellow. Head, with the genæ and face shining, impunctate; occiput very finely and transversely aciculate, opaque; antennæ but little shorter than the body. Pro- and mesothorax and scutellum opaque, sculptured like the occiput; metathorax distinctly rugose. Pro- and mesosternum shining, impunctate. Wings sub-hyaline; stigma dusky, paler at base. Abdomen with the two basal joints opaque, densely and moderately strigose longitudinally, the basal joint with two short, oblique basal carinæ. Joints, three to five, very finely and longitudinally strigose anteriorly, smooth and shining posteriorly; the succeeding joints smooth and shining.

Described from 8 ♂ and 2 ♀, bred from *Prodoxus decipiens*, part issuing in autumn, part in spring.

The larva is, when full-grown, about 4^{mm} in length, elongate, not curved, attenuate at each end. Head white and smooth; mouth-parts difficult to distinguish, being unicolorous with the head; the rest of the body is yellowish-white, less shining; thoracic joints not differing in shape and length from the abdominal joints. It is an interesting fact that the larva does not seem to spin a separate cocoon of its own, and the fly gnaws its way out of a small circular hole of the size of an ordinary pin hole.

THE

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A FOE TO COTTONWOOD.

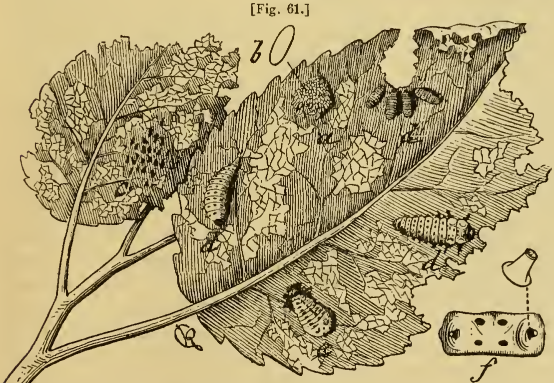
The Streaked Cottonwood Beetle.

" A subscriber at Lone Star, Butler County, Neb., writes that an insect is doing great damage to the cottonwood trees in that locality. The letter was received some time ago, but it will be impossible to give a positive answer from the few notes given. The short description given would indicate that the insect of which the writer speaks is a beetle, and belongs to the *Chrysomelidæ*, but I know of no species of this leaf-eating group which injures the Cottonwood. I will be glad to determine it if the party will send me specimens of the beetle, or if specimens cannot be found, an exact description of how it works, the part of the tree it injures, and the time of year it is found."—Cyrus Thomas, in *Prairie Farmer*.

The insect referred to is beyond doubt the *Plagiodera scripta* Fabr., a most abundant species infesting Cottonwood and other species of *Populus* throughout the West and south to Louisiana. We have received it from many of our correspondents in Nebraska and other western States, and all report it as destructive to the leaves of the Cottonwood.

In the New York Weekly *Tribune* for Oct. 9, 1878, we first drew attention to this insect in the following words:

[Fig. 61.]



PLAGIODERA SCRIPTA. *a*, eggs *b*, one enlarged; *c*, newly hatched larvæ; *d*, *d*, *d*, larvæ of different sizes; *e*, pupa—natural size; *f*, one of the middle joints of body of larva from above, showing tubercles—enlarged (after Riley).

This insect has long been known to affect our willows, but not usually to an injurious extent. The larva is peculiar for emitting from the tips of its tuberculous spines a milky fluid which has a peculiarly pungent but not altogether disagreeable odor. It transforms on the leaf by fastening its hind legs to it, and the pupa remains within the partially thrown off larva skin. The beetle is one of the most variable species we have. The typical form has the thorax black with the sides yellow, except a small spot each side, and the wing-covers yellowish, with three interrupted lines of black or bluish spots. In the varieties these spots either diminish in size or they increase, and specimens are not rare where the wing-covers are of a uniform blackish blue. In rare cases the whole beetle, including the thorax, is uniformly blue. The interesting feature about this insect to the forester, however, is that it has of late years acquired an especial liking for the Cottonwood.

It has, indeed, become a most grievous pest in the prairie States, where the Cottonwood is largely grown as a shade and ornamental tree, as well as for fuel. We have been surprised, in passing through Kansas and Nebraska more particularly, at the utter devastation which this beetle has produced. Vast groves have been destroyed through its incessant defoliation. Now the Cottonwood is placed by botanists in a genus different from that of the Willows, and the strangest thing about it is that the Willows are not injured to the same de-

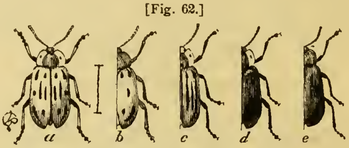
gree, even where growing in the neighborhood of the injured Cottonwood. This is partly due, perhaps, to the fact that the Willow does not suffer so much from defoliation as does the Cottonwood, though it is possible that a special Cottonwood-feeding race of the species has been of late years developed in those sections where the tree is so largely planted. This would be parallel to the well-known case of the Apple-maggot (*Trypeta pomonella*), which, though infesting wild haws and crabs in all parts of the country, has only taken to feeding on and injuring cultivated apples in some of the New England States. The Cottonwood could probably be freed from the injuries of the beetle we are considering by syringing the trees with Paris-green water.

The perfect beetles, as is generally the case with the members of this family, hibernate in sheltered situations. They may be seen pairing and laying soon after the Cottonwoods begin to leaf in the spring. The eggs (Fig. 61, *a*), which are elongate-oval, of a pale yellowish-white color, rather soft, and about 0.5$^{mm.}$ long, are laid in dense clusters of ten upward to a hundred. When first hatched the larvæ are almost wholly black, and congregate near their egg shells, skeletonizing the leaf as shown in Fig. 61, *c*. In the month of June we found the second brood of larvæ in Nebraska just hatching and commencing to work, and we had the assurance of Prof. Aughey that there were at least three annual broods. We think it probable that there are even more, as the insect is not only a voracious feeder, but goes through its transformation with great rapidity, only fifteen days being required in the month of August from the hatching point to the issuing of the perfect beetle, as has been determined by Prof. F. H. Snow.* We found the insect in all stages everywhere in Colorado where the Narrow-leaved Cottonwood was growing. The larva is marked, as shown in Fig. 61, *d*, and Fig. 64, *a*, and we append a more detailed description of it when full grown :

Plagiodera scripta—*Larva*—color dingy, yellowish-white ; head and legs polished black. Venter with three rows of dusky, highly polished spots becoming confluent on joints 11 and 12, the middle row double but confluent. On joints 2, 3, and 4, the outer rows are represented by a mere speck, and on joint 1 they are obsolete. Laterally there are two rows of somewhat darker, more elevated tubercles, the upper row the largest, the lower one obsolete on thoracic joints. Dorsally there are four distinct rows, the outer rows consisting of distinct tubercles from the tops of which a milky fluid can be thrust. On joints 2 and 3 these tubercles are somewhat lower down than on the other joints, and raised on a bulbous swelling, and the intermediate space between them and the medio-dorsal tubercles is swollen and paler than the rest of the body, and surmounted by two or three quite minute dusky specks. The stigmata are black, the first pair on a fold which seems to belong more to the second than to the first joint, the others normally placed between the upper lateral and lower dorsal tubercle. Pseudo-pod, pale.

There is a closely allied species, the *Plagiodera lapponica* Linn. (Fig. 63), which

[Fig. 62.]



Plagiodera scripta: *a*, beetle, normal form ; *b*, *c*, *d*, *e*, showing variations (after Riley).

feeds more particularly on Willow, as we have found it quite commonly on Black Willow in Missouri. The accompanying figure will show the more perceptible colorational differences between this and the preceding species, the more constant structural difference between the two consisting in the claw-joint being dentate beneath in *scripta*, and simple in *lapponica*.* But the larvæ of the two are so much alike as not to be easily distinguished even upon the closest scrutiny. A third species of the genus, viz., *P. tremulæ* Fabr., is found in the more northern parts of the continent, and like *P. lapponica*, it is common to both Europe and America. Here it injures the leaves of the common Aspen (*Populus tremuloides*), the beetle itself being easily distinguished by the uniformly steel-blue color, with the exception of the wing-covers, which are just as uniformly clay-yel-

[Fig. 63.]

Plagiodera lapponica.

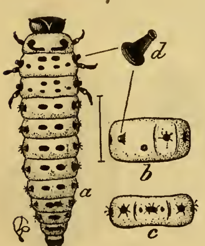
*Observer of Nature, Lawrence, Kan., November 23, 1875.

* As both species are very variable and both have the uniformly steel-blue form, and as their larvæ are undistinguishable, it may be questioned whether this structural feature can be relied on, and we opine that *lapponica* (Linn.) like *confluens* (Rogers) and perhaps *obsoleta* (Say) are but pronounced forms of this *scripta*, though science will be best served by referring to them under their several names.

low, verging to reddish. It is a curious fact that *lapponica* extends to the more Southern States on this continent and is sub-arctic in Europe; while *tremulæ*, which is sub-arctic here, extends to the more southern countries of Europe.

In meeting with the larvæ of the two commoner Western and Southern species here mentioned (*P. scripta* and *P. lapponica*), we have often endeavored to ascertain whether they possess any differing characters that would permit us to decide positively which species of beetle they would produce, and after a good many comparisons both of the living and preserved larvæ, we have concluded that there are no differences that can be positively relied on. The latter species emits the milky fluid more freely and has perhaps a more pungent odor. The larva of *P. tremulæ* is at once distinguishable, however, by its darker hue, all the spots being comparatively larger and broader, and by having a distinct spot on the second and third joints following the head, in the dorsal space which is so pale and occupied by mere specks in the other species. In this respect *tremulæ* agrees with the European *populi*, which, being a larger species, we here illustrate (Fig. 64), to show the relative positions of the spots and tubercles. This last larva is distinguished not only by its larger size, but by the paler prothoracic shield, which in all three of the other species is dark.

[Fig. 64.]



LARVA OF PLAGIODERA POPULI: *a*, dorsal view; *b*, side view of one of middle joints; *c*, ventral view of same; *d*, one of the tubercles—greatly enlarged (after Riley).

What with the injuries of the Cottonwood Borer (*Saperda calcarata* Say), which are now most severe in the West, and the defoliations by this leaf-beetle, the Cottonwood, which has an especial value in the West, both because of its rapid growth and hardiness, seems doomed to follow the Black Locust in succumbing to insect enemies. The Streaked Cottonwood Beetle may, however, be managed by syringing the trees with the wet preparation of London Purple or other arsenical compound.

In order to illustrate the color variations this *Plagiodera scripta* is subject to in the perfect state, we tabulate below some of the more marked varieties, with the remark that various combinations of them occur.

VARIETIES OF PLAGIODERA SCRIPTA.

a. *Typical.* Black with a tinge of blue; basal joints of antennæ beneath, thickened thoracic margin with exception of a small round spot at the middle, elytra with exception of suture and three lines of interrupted black markings, base of femora and part of tibiæ, and sides and apex of abdomen, testaceous yellow. (Common West).

b. *Variations in general coloration:*

b. 1. Base of antennæ, head, underside, and legs, of the same yellowish color as upper side. (From Texas.)

b. *α*. Thorax testaceous-yellow, or more reddish, with the two lateral markings and a *Υ*-shaped mark on the disk blackish.

b. . Thorax entirely testaceous-yellow.

b. 2. Principal color above and beneath blue; legs blue.

b. *γ*. Sides of thorax as in typical form. Elytra with faint yellow marking. (From California.)

b. *δ*. Sides of thorax as in typical form. Elytra unicolorous blue. (From California.)

b. *ε*. Entirely blue, except a narrow lateral yellowish marking each side on the last abdominal joint.

c. *Variations in the markings of the elytra:*

c. 1. Marked with black as follows: the suture; two more or less oval spots near the base, the inner of which is nearer to the suture than to the lateral margin, and the outer on the humerus; three longitudinal striæ on the middle, the intermediate of which is the longest; submarginal curved stria and an oval spot between the latter and the suture. (Common West.)

c. 2. Additional marks: A small triangular basal spot in front and between the two subbasal markings. (Illinois.)

c. *α*. This triangular spot is sometimes connected with the humeral spot. (California.)

c. *β*. Black markings become wider or longer and then often confluent.

c. *γ*. Markings in general becoming smaller, either all of them, or one or several of them.

PHYLLOXERA-PROOF VINES.

In a recent address before the Mississippi Valley Grape-grower's Association, Mr. Geo. Husmann, so long and well known for his efforts in behalf of this industry, after extolling the merits of some of the newer seedlings of the Taylor, the wine from which he compares with the best Johannisberg and Deidesheim Riessling, remarks :

While Mr. Rommel has perhaps attained the first and most marked results with his Taylor seedlings, others have experimented with them also. I will mention here the Uhland of Mr. H. Weizdemeizer, at Herman, which makes a wine of very high character; the Noah of Mr. Wasserzeicher, of Nauvoo, Ill., which is already well known among grape growers ; but especially the seedlings grown by Mr. Nicolas Grein, of Herman, which make a wine equal to the choicest hocks, and which may safely be brought in competition with the best Johannisberg and Deidesheim Riessling.

This class is also phylloxera-proof, and as all of them grow very readily from cuttings, they are very easily propagated, and millions of cuttings have already been shipped to France, and even California, of the Taylor and Elvira—the only ones accessible in quantity—to serve as stocks to graft their Vinifera upon, as well as to test their wine-making qualities. They are all exceedingly hardy, withstanding the severest winters without injury, and very little, if any, subject to rot. We are therefore working upon a sure basis, and need not fear the reverses of the past, while we can produce from them a wine which can compete with the most renowned of Europe.

While, therefore, the prospects of Missouri grape growers rest upon a surer basis than ever before, while we think that we see our way to a grand success, the prospects of France, Germany —in short, all the grape-growing districts of Europe—are darkening; and even California begins to feel the ravages of that insidious enemy, the phylloxera. All look to us for relief, in the shape of cuttings and plants of our phylloxera-proof varieties. There were not cuttings enough of Taylor and Elvira in the State last year to meet the demand from abroad, and the sale of them, of the trimmings of our vineyards, will form a considerable source of revenue to our vintners.

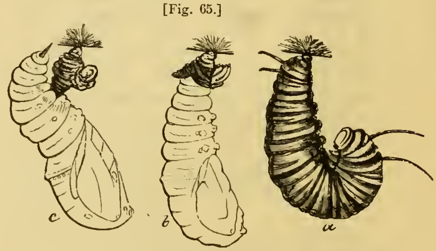
Bug injuring Box-elders.—Last fall the box-elders, young soft maples, and ash trees, on the College grounds, were infested by a black, red-lined plant-bug—the *Leptocoris trivittatus* of Say—that punctured the bark of the trunk and limbs, feeding upon the sap. These bugs have passed the winter in sheltered situations in considerable numbers, and may prove troublesome during the coming season. The young bugs are most injurious, as they appear in much greater numbers, but may be brushed from the tree with a broom and destroyed upon the ground. This mode of operation is rendered more successful by their habit of congregating on certain parts of the tree, at this age. They are then chiefly red in color, acquiring the black with their wings in the adult state.—*Prof. E. A. Popenoe.*

PHILOSOPHY OF THE PUPATION OF BUTTERFLIES, AND PARTICULARLY OF THE NYMPHALIDÆ.*

BY CHAS. V. RILEY.

The comparatively sudden transitions from one state to another in insects have always excited the keenest interest. The change from larva to chrysalis in those butterflies known as *suspensi*, and which in the chrysalis state hang from the tip of the body, has, perhaps, been looked upon as the most wonderful. The preliminary acts in the performance have been pretty well observed and described by various

[Fig. 65.]



Ideal figures of *Danais archippus*, illustrating the method of pupation formerly accepted : *a*, suspended larva ; *b*, forming chrysalis with shriveled larva skin ; *c*, method of holding skin during the last critical act (after Riley).

authors since the days of Vallisneri, the larva hanging by the anal end, turning up the anterior part of the body in a more or less complete curve, and the skin finally splitting from the head to the front edge of the metathoracic joint and being worked back in a shriveled mass toward the point of attachment. Now comes the critical feat which has most puzzled naturalists, viz., the independent attachment of the chrysalis and the withdrawal from and riddance of the larval skin which such attachment implies.

Réaumur explained it in 1734 by the clutching of the larval skin between alter-

* Read before the Am. Association for the Advancement of Science, at Saratoga, August, 1879.

nate sutures of the soft joints of the chrysalis, and his happy and circumspect account, from observations made on *Vanessa urticæ*, has formed the basis for subsequent accounts, or, at least, no one obtained a deeper insight into the philosophy of the act until, some two years since, Dr. J. A. Osborne, of Milford, England, discovered that a distinct membrane is concerned in it. In casual observations of the process I had long become convinced that the popular accounts were crude and inaccurate, and had preserved specimens in the act of transforming, for future study ; but the philosophy of the change cannot be satisfactorily made out from alcoholic specimens alone, nor from the study of one species. The present paper is based on observations made on species in more than a dozen genera, the conclusions having been partially presented last June to the Philosophical Society of Washington.

The body of the larva is composed (exclusive of the head) of 12 segments or joints, *and a subjoint.* It is with this subjoint that we have here to deal, for to it are appended the anal prolegs beneath, and the anal plate above the rectum.

If we carefully examine the anal plate of the larvæ of the true *suspensi*, we shall find that while it differs in form it has one feature in common, viz., the being furnished dorsally and posteriorly with numerous short spines and points, generally retrorse, or so placed that the larva can make use of them in suspending. The special spines on the anal plate are only fully developed after the last larval molt, being more or less obsolete in the earlier stages, and they are also under muscular control. Even in the *succincti*, where, as a rule, the anal plate is not specialized, spines are nevertheless sparsely found, especially on the hind border.

All writers that I have consulted speak of the larval suspension being due to the entanglement of the hooks of the anal prolegs in the silk, and do not mention the use of the anal plate, for which the hillock of silk is sometimes spun in special form.*

The normal form of this hillock may be likened to that of an inverted settee, or to a shoe, or to a ship knee, and one of the most interesting acts of the larva, preliminary to suspension, is the bending and working of the anal parts in order to fasten the back of the plate to the inside of the back of the settee, while the crotchets of the legs are entangled in the more flattened position or seat. In some cases (as in *Danais*, Fig. 70, *a*) the hillock of silk is more elongate, and the spines of the truncate plate occur most around the lower margin, and even beneath it, so that in fastening them the larva seems to be drawing the silk up the rectum. In other cases (as in *Euptoieta*) the plate, in addition to the spines, has a prominent tubercle on each anterior outer border, well calculated to lock securely into the silk. After suspension, and as the fluids gravitate anteriorly, the silken hillock becomes more conical (the threads being loosely spun and elastic), and the hooks both of the plate and the prolegs hang more loosely from it.

In the final getting rid of the larval skin and attachment of the chrysalis there are concerned :

1st. Certain features belonging to the larva and cast off with its skin ; 2d. Those belonging to the chrysalis ; and to intelligibly explain the process it is necessary to more fully characterize and homologize those parts than has hitherto been done.

In the former category, in addition to the natural adhesiveness of the moist and mucous separating membrane, there are three physiological factors concerned : 1st. The *tracheal ligaments* (Figs. 66, 68, *tl*) or the shed tracheæ from the last or ninth pair of spiracles, which uniformly become blind or obsolete in the chrysalis; 2d. The *rectal*

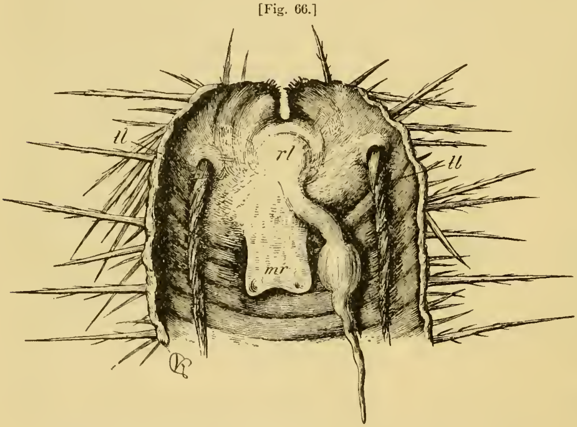
* It is an interesting fact in this connection that Rösel, who has never had any superior as a delineator of insect larvæ, makes the Nymphalids in his figures all suspend to an elongate, conical piece of silk, apparently issuing from the anus, with the legs invariably free and in no instance hooked. It is evident, however, from his text, that he was not aware of the use of the anal plate, and since he speaks of the larvæ attaching themselves by the hind legs or extremity, it is equally evident that his figures do not correspond with the text ; while the freedom of the legs in his figures is, of course, an error.

ligament (Figs. 66, 68, *r l*) or shed intestinal canal; 3d. The Osborne or retaining membrane (*membrana retinens*, Figs. 66, 68, *m r*), which is but a stretched and specialized part of the mucous membrane* that accumulates around the rectum and in the anal prolegs, and that is intimately connected with the rectal ligament.

In the second category we have certain structural features of the chrysalis. (See Figs. 68, 69, where corresponding parts are similarly lettered.) These are:

First. The *cremaster* proper (*c*), which is the homologue of the anal plate of the larva, and the form of which is foreshadowed in that of said anal plate. This cremaster assumes a great variety of different forms, but in general may be said to be a tapering piece, more or less incurved ventrally, and having the ventral and dorsal margins thickened or ridged, and these ridges may be respectively called the *ventral* and the *dorsal cremastral ridges* (*v c r* and *d c r*). This cremaster is surmounted at the apex and sometimes along the ventral ridges by what may be called the *cremastral hook-pad* (*c h p*), thickly studded with minute but stout hooks, which are sometimes compound or furnished with barbs, very much as are some of our fishing-hooks, and which are most admirably adapted to the purpose for which they are intended. (Fig. 68, *h*.)

[Fig. 66.]



Shrunken larval skin of *Vanessa antiopa*, cut open from the back, and showing (*m r*) the retaining membrane, (*r l*) the rectal ligament and (*t l*) the tracheal ligaments (after Riley).

Secondly. We have the sustainers (*sustentores*), two projections which homologize with the soles (*plantæ*) of the anal prolegs, and which take on various forms (*s*), but are always directed forward, so as to easily catch hold of the retaining membrane. In the yellow butterflies (as *Calydrias*, *Terias*, *Colias*), where the body of the chrysalis is so thrown back that mere projecting tubercles would not suffice, we find them transformed into actual hooks (Fig. 69, *A*, *s* and *E*); while in some of the *succincti* they are little more than a thickening of the anterior margin of the subjoint. In all Lepidopterous pupæ these remnants of the anal prolegs are more or less indicated, while in certain moths (*Pterophoridæ*), where the pupa is partly suspended as it is in the *Nymphalidæ*, they are covered with long hooks similar to those at the tip of the cremaster and to those which, in the larva, armed the hind plantæ.

Thirdly. We have what may be called the *sustentor ridges* (*s r*) usually connected with the sustainers, and embracing them on the outside, and extending backward to the inside of the ventral cremastral ridges, and sometimes, as in *Paphia* (Fig. 69, *B*) and *Limenitis*, there forming quite a deep notch, which doubtless assists in catching hold of the larval skin in the efforts to attach the cremaster. These sustentor ridges are homologous with the limb of the anal prolegs, and the exposed edge with the posterior border of said

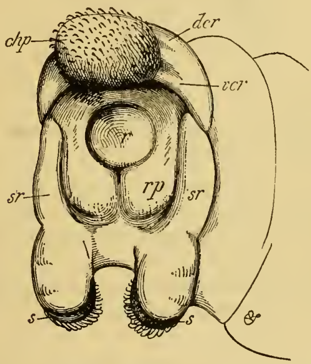
* I designate by this name the colorless lining of the larval skin that separates from the forming chrysalis. If, as recent physiological research indicates, it is only the outer half of the outer or epidermic layer of the skin (*cuticula* of modern histologists) which is cast off in the exuviation of invertebrates, then this mucous lining is developed between the two separating layers of said *cuticula*.

limb. They vary much in form, and may be more or less obsolete.

Fourthly. Between them is what may be called the *rectal piece* (*r p*), consisting of a piece more or less well marked and elevated, especially around the closed rectum.

It is principally by the leverage obtained by the hooking of the sustainers in the retaining membrane, which acts as a swinging fulcrum, that the chrysalis is prevented from falling, after the cremaster is withdrawn from the larval skin. It is also principally by this same means that it is enabled to reach the silk with the cremastral hook-pad. Yet the rectal ligament

(Fig. 67.)

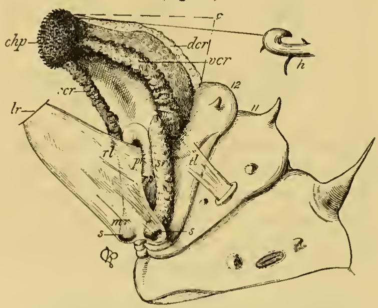


Ideal representation of the anal subjoint of the larva of *Vanessa antiopa*, from behind, with the spines removed and all the parts forced apart by pressure so as to show the homologies of the parts in the chrysalis which are concerned in pupation; the homologies indicated by corresponding letters in Fig. 68, except that *r* (the rectum) corresponds with *p r* in Fig. 68 (after Riley).

plays a most important part, and in some species a more important part even, in my estimation, than the membrane itself. The tracheal ligaments, which, from a study of specimens plunged in alcohol when the larval skin was about half shed, I was at first inclined to believe important auxiliaries, are, I am now satisfied, of very little or no service in most cases. The rectal ligament is a constant physiological factor, and its importance cannot be ascertained by attempts to sever the membrane at the critical moment, because in such attempts the ligament is more or less drawn out beyond the power of the sphincter muscles in the chrysalis to control it.

Dissected immediately after suspension, and the subjoint of the larva will be found to be bathed, especially between the legs and around the rectum, in an abundance of translucent, membranous material. An hour or more after suspension the end of the forming chrysalis begins to separate from the larval skin, except at the tip of the cremaster (see Fig. 70, *b*). Gradually the skin of the legs and of the whole subjoint stretches, and with the stretching, the cremaster elongates, the rectal piece recedes more and more from the larval rectum, and the sustentor ridges diverge more and more from the cremaster, carrying with them, on the sustainers, a part of the soft membrane. If a larva be carefully

(Fig. 68.)

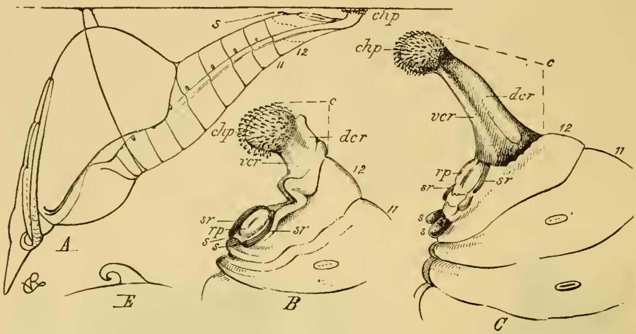


Anal parts of chrysalis of *Vanessa antiopa*, just prior to final extraction from larva skin: *c*, cremaster; *chp*, cremastral hook-pad; *h*, one of the hooks more enlarged; *vcr*, ventral cremastral ridge; *dcr*, dorsal cremastral ridge; *lr*, larval rectum; *pr*, pupal rectum; *rp*, rectal plate; *sr*, sustentor ridges; *s*, sustentores; *mr*, membrana retinens; *rl*, rectal ligament; *tl*, tracheal ligament; the 11th or last spiracle-bearing joint and the 12th joint being numbered (after Riley).

dissected at this stage, the forming membrane may be raised with the point of a needle and stretched so as to show its connection with the rectal ligament (Fig. 70, *d*); or it may be lifted entirely from the retainers, when, by its elasticity, it contracts and becomes more or less fully absorbed in the rectal ligament (Fig. 70, *e*). It is at this stage that the strength of the latter may be fully tested, and if, after the larval skin and retaining membrane are carefully removed without loosening the rectal ligament, the chrysalis be grasped in the neighborhood of the rectum so as to supply the natural holding power of the sphincter muscles, the ligament will sustain, as I have

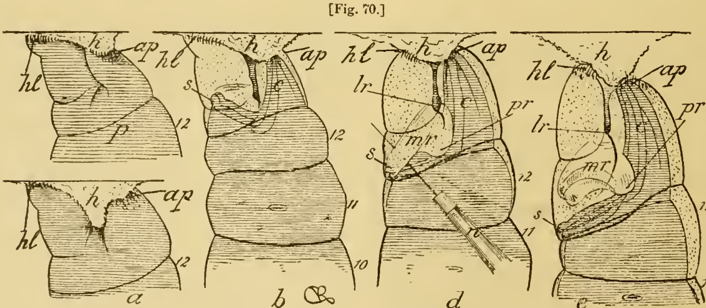
abundantly proved, at least ten or twelve times the weight of the chrysalis; while it will support, if held by the larval skin, several times the weight of the chrysalis, before separating therefrom. Experimental proof is easily obtained by pinning the larval skin, which has been flayed from the chrysalis, to a small piece of cork and then, while grasping the chrysalis as indicated, sticking additional pins in the cork, until the increasing weight breaks the ligament. and always intimately connected with and forming but a branch of the rectal ligament. When extended from its attachments, as when the chrysalis rises to the silk, this membrane dries, and in the cast-off larval skin retains, more or less perfectly, the stretched form. If the mucous membrane of the larva was thick and strong, as in *Vanessa*, the dried membrane will be broad, with two indentations where it was held by the retainers; if more delicate, as in *Danais*, *Paphia*, or *Apatura*, the dried membrane is more forked, showing how the retainers have acted upon its elasticity. In every

[Fig. 69.]



A, chrysalis of *Terias*; *B*, posterior end of chrysalis of *Paphia*; *C*, do. of *Danais*; *E*, one of the sustainers of *Terias*, greatly enlarged to show its hooked nature; all the parts of subjoint lettered to correspond with the same parts in Fig. 68 (after Riley).

[Fig. 70.]



PUPATION OF BUTTERFLIES:—*a*, attachment of larva of *Danais archippus*; *p*, do. of *Paphia glycerium*; *b*, ideal larva soon after suspension; *d*, do. a few hours later, the needle (*n*) separating the forming membrane from the sustainers; *e*, do. just before splitting of larval skin, with retaining membrane loosened from the sustainers and showing its connection both with the larval and pupal rectum. In all the figures the joints of body are numbered; the forming chrysalis is shaded in transverse lines; the intervening space between it and larval skin is dotted; *h* is the hillock of silk; *hl*, hooks of hind legs; *ap*, anal plate; *lr*, larval rectum; *pr*, pupal rectum; *mr*, retaining membrane; *c*, cremaster; *s*, sustainers (after Riley).

In brief, the retaining membrane is that part of the inner larval skin surrounding the prolegs, drawn down by the sustainers,

case, however, it shows, under the microscope, the longitudinal folds and creases incident to the stretching, and compared to the rectal ligament proper it seems to lose importance as it is less needed; for the *succincti* will generally attach when it is severed or loosened from the retainers, while in *Apatura* (at least as exemplified in the North American species), which combines the peculiarities of both the *succincti* and *suspensi*,* it does not become specialized, and the chrysalis seems to rely almost entirely on the rectal ligament, assisted by the partial holding of the delicate larval skin, not only between what is left of the sustainers and the ventral posterior margin of the twelfth joint, but between the ventral sutures of this last and the preceding joint. And here I would remark, in conclusion, that the ventral borders of two or three of the joints preceding the subjoint are, in most chrysalides which I have studied, so hardened that the mucous membrane is actually grasped between them and the deep sutures made in contracting, or (what would be a more correct statement of the fact) it remains, adhering in these sutures after the outer skin is loosened, in the same way that the membrane remains on the sustainers. In some instances (especially in some species of *Papilio*) the posterior border of the twelfth joint is produced into a medial transverse ridge fully as prominent as that formed by the sustainers, which here are flattened and coalesce. So that the sutures of some of the terminal joints in the chrysalis do subserve the purpose ascribed to them by Réaumur, but in a somewhat different way.

AN INTELLIGENT WASP.

While it may not make any great difference in the final winding up of the affairs of the human race whether we call the intelligence of the lower animals instinct or reason, still there can no great harm come from making observations, and becoming acquainted with the habits of the minute as well as larger creatures with which we are surrounded. The entomologist, in his investigations of the habits of insects, frequently finds some species displaying more than ordinary intelligence, or exhibiting what would be called, among the higher orders, reasoning powers, that are frequently manifested in their evident premeditated actions and calculations as to the chances of accomplishing their purpose by taking advantage of the variable conditions or circumstances by which they are surrounded. One of the most interesting exhibitions of insect skill (if we give it no better name) that has come under my observation is annually performed by the Handsome Digger Wasp (*Stizus speciosus* Drury, Fig. 71,) that frequents my garden. This wasp provisions its nest with the Dog-day Cicada (*Cicada canicularis* Harris). In my grounds it takes the Cicada principally if not wholly, as I have never found any other insect in its nest. This wasp appears to know that it would not

[Fig. 71.]

STIZUS SPECIOSUS.

be safe to dig its burrow in ground that is being cultivated during the summer, and for this reason it frequents paths and roads but little used, preferring moderately light and dry soils. In such places it digs its burrows, which are about three-fourths of an inch in diameter and two or more feet in length. They are not perpendicular, but for the first twelve to eighteen inches the wasp digs at an angle of about forty-five degrees, then turns upward a few inches to the end.

The earth taken out of the excavation

* The larva of *Apatura* attaches horizontally, making the front pair of abdominal prolegs answer the purpose of the girth; but in the shedding of the skin this attachment is severed, and the forming chrysalis assumes the perpendicular position, and in the withdrawal and attachment of the cremaster, it acts as the true *suspensi*.

is left in a heap near the entrance of the burrow. When the burrow is completed the wasp begins to look about for a victim, which, when found, is not killed but merely paralyzed with her powerful sting. The Cicada is then taken to the burrow, dragged into it, and an egg laid upon the body. The wasp, however, often finds it somewhat difficult to transport her victims from the place where captured, to her burrows, because the Cicada is really the larger insect of the two, and it also frequents forests and groves that are often far distant from the open field where the wasp has made her nest. It is in this transportation of her victims that she displays her consummate skill, not relying wholly upon her own strength, but taking advantage of the wind and other conditions likely to aid her in the work she has to do.

Among the many instances that have come within my own observation, of this handsome burying wasp taking advantage of the wind to secure or transport her victims, there is one that I will relate, inasmuch as it has been so often repeated, that I cannot doubt the premeditated design of the insect. To make the matter plain to the reader I will state that the wasps frequent the main walk or road through the center of my grounds, this road running nearly due west to east, slightly descending the entire length, and it is altogether some twenty-five or thirty rods long. For the first half of the distance this road is bordered on both sides with trees and shrubs, some of considerable height. The wasps go beyond these and make their burrows, and within a few rods of the lower end, where there is little to obstruct their flight or work in digging their holes. The nearest forests or woodland are to the east and north, and on still lowei grounds, from which it would be impossible for the wasps to obtain a supply of Cicadas, while to the west and south they would have to go much further to find their prey. But unfortunately for the latter, but fortunate for the wasps, there is a small grove of about two acres of large old trees on the west side of my place, and up to which the main walk referred to leads. This grove stands upon still higher ground or about twenty feet higher than the point selected by the wasps for their nests. The land about the trees has never been broken up and the Cicadas breed among these old trees and in the ground undisturbed except by their inveterate enemy the Digger Wasp.

With the first drumming of the Dog-day Cicada the wasps appear and the battle commences, and the "tug of war" is in getting the Cicadas from this grove down the path to the burying ground. When the wind blows from the south, east, or north, the Cicadas have peace, but let a breeze spring from the west and then the wasps will begin their murderous work in earnest. As my office stands on the highest point in the grove named, I have abundant opportunities of witnessing the war of races going on and the tactics of the combatants, although it may be said that the armor of the Cicadas soon yields to the deadly thrusts of the wasps. With the first onslaught the Cicada usually falls to the ground, the wasp following immediately, getting astride of its back, clasping her victim with her two front legs, the four hind ones being left free. She quickly ascends the nearest tree, sliding the Cicada up the bark quite rapidly. When the topmost branch is reached, or the wasp thinks she is high enough, she lets go, flying with the wind toward the resting place many rods to the eastward. In one instance a wasp carried her victim up an oak tree on the west side and close to my office, but as the tree reached above it she carried her victim safely over and landed within a rod of her burrow. I followed her as rapidly as my legs would carry me, and found her still astride of the Cicada, trying to slide it along toward the rest. Where the path was firm she succeeded very well, but when striking loose sand she could not obtain a good foothold and had to dismount, turn around and drag the prey along after her. When the mouth of the hole was reached she soon disappeared with her victim. In the meantime I had sent for a spade, with which herself and victim was unearthed, for

the purpose of learning something of the next and subterranean act in the drama. The Cicada was found at the extreme end of the burrow lying on its back, and the long slender semi-transparent egg of the wasp carefully slipped under the thigh or femora of one of the front legs.

I have never found more than one Cicada in a burrow, but it seems strange that the wasp should work so long and industriously in order to bury one victim and lay only one egg.—A. S. F.

THE COLORADO POTATO-BEETLE.

(Continued from p. 118.)

NATURAL HISTORY AND TRANSFORMATIONS.

Prof. Riley was the first to make known the natural history and transformations of the Potato-beetle, in the *Prairie Farmer* for August 8, 1863, and they may be briefly summed up as follows: The female beetle deposits her eggs on the underside of the leaves, in clusters of a dozen, up to fifty or more. The eggs are of an orange color, and hatch in about a week after being laid, the grubs immediately commencing to feed and continuing until mature, which occurs in from fourteen to eighteen days, varying somewhat as the weather may be favorable or unfavorable. When full grown, the larvæ descend to the ground and hide under leaves or rubbish, or burrow into the soil, where they remain for about ten days, then come forth in the perfect or winged form. Two to four broods are perfected during the season, according to the locality and length of the season, the last brood descending into the ground in the perfect or beetle state, and remaining in a dormant condition over winter,—reappearing as soon as the ground has become sufficiently warm to awaken them from their long slumbers. The beetles at this time may usually be seen crawling about very rapidly, looking for the first shoots of the potato as it appears above ground, which they attack as though their appetite had been sharpened by a long fast.

METHOD OF DESTROYING.

The first step or most practical method of making war upon this insect is the destruction of the few or many that come out of the ground in spring, for each female killed at this time may safely be said to represent five to ten hundred in the succeeding generation, for she will, if not prevented, lay about that number of eggs. Some persons, however, claim that it is much the best way to allow the beetles to take their own course, and then destroy the larvæ a few days later, when they have fairly commenced feeding upon the leaves, by applying some one or more of the various poisons recommended for this purpose. That either the beetles or the grubs must be destroyed in order to save the crop, is now generally admitted, and the only room for a difference of opinion is as to how it should be done. Scores of different substances have been tried for this purpose, copperas, lime, mandrake tea, and other common insecticides, but none have proved so effectual and economical as Paris green and other arsenical compounds. That these poisons are dangerous to have about a place, is admitted, and so are sharp knives, reapers, and mowers, still it is not as easy to do without them as to be a little careful in using, and thereby avoid accidents. The Paris green is destructive to the Potato-beetle in both its perfect and larval states, and one pound of the poison, mixed with twenty of pulverized plaster, or of any common kind of flour, and dusted over the leaves while wet with dew in the morning, or after a shower, will quickly cause the death of all the grubs or perfect insects feeding thereon.

A duster should be used for applying the poison, and one made of tin, with a perforated bottom, and attached to a handle four or five feet long, will be found a very convenient implement for this purpose. But the operator should be careful not to allow the compound to blow into his face, or inhale it while at work, it being only necessary for him to keep in mind that he is handling a virulent poison, and act accordingly. The green may also be applied by mixing it with water, but as it will not dissolve, but is merely suspended in the

liquid, it is necessary to frequently agitate the mixture in order to prevent the poison settling to the bottom, as well as to insure its uniform distribution over the leaves. But water is a heavy material to handle, and unless one has the conveniences for applying it, the dusting process will be found the most economical, as requiring the least labor.

The recently introduced London purple, referred to in our February number (page 41), may be applied in the same way as Paris green, and will prove equally effective, besides being much cheaper.—A. S. F.

THE NORTHERN ARMY WORM.

There has been a very marked irruption of this insect the present season in many parts of Maryland, Delaware, and especially in New York and on Long Island, where the worms seem to be most injurious; so much so as to cause the leading daily journals of New York City to give a good deal of attention to it. As is usual in such cases a great deal of nonsense is published and all sorts of explanations offered of the cause of their sudden appearance. Since our discovery and description of the eggs, and of the method of egg-laying as given in the 8th and 9th Reports on the Insects of Missouri, and in the Walker prize essay of the Boston Society of Natural History for 1877, the natural history of the insect may said to be fully known.

[Fig. 72.]

Full-grown Army Worm (after Riley).

CHARACTERS.

The worm when full grown is dingy black in color, striped as in our illustration (Fig. 72) with a broad dusky stripe along the back, divided along the middle by a more or less distinct and irregular pale line and bordered beneath by a narrow black line; then a narrow white line; then a yellowish stripe; then a narrow, indistinct white line; then another dusky stripe; again a narrow white line; then a yellow stripe, and, finally, again a faint white line: the underside or venter is obscure green.

[Fig. 73.]

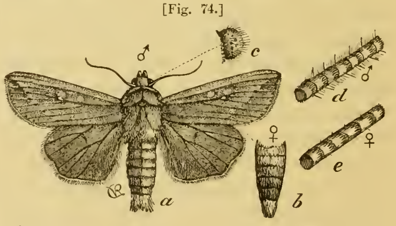
Chrysalis of Army Worm.

The chrysalis (Fig. 73) is mahogany-brown in color. The moth (Fig. 74) is of a fawn color, with a white speck near the centre of the front wings and a dusky, oblique line running inwardly from their tips.

NATURAL HISTORY.

The eggs are laid in the spring of the year so far as we now know, and not in the Fall as was formerly supposed. They are thrust, by means of an ovipositor (Fig. 75, *b*) admirably adapted for the purpose, in between the folded sides of a grass blade and glued along the grooves with a white, glistening, and adhesive fluid, which not only fastens them together but draws the two sides of the grass blade close around them so as to pretty effectually hide them. The female performs this operation at night and is ex-

[Fig. 74.]



Army Worm Moth:—*a*, male moth; *b*, abdomen of female—nat. size; *c*, eye; *d*, base of male antenna; *e*, base of female antenna—enlarged (after Riley).

tremely active at the time, laying her eggs with great rapidity, so that the ovaries are soon emptied. Each individual egg (Fig. 75, *g*, *h*) is glistening white at first, but becomes dull yellowish toward maturity. The female prefers a dry blade to a green one, and is especially prone to oviposit in places where there is a thick matting of coarse, last year's grass.

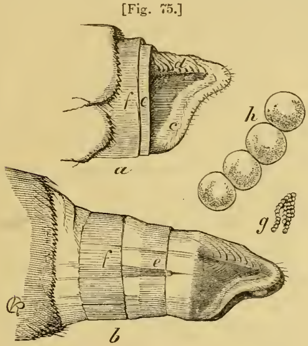
The young worm hatches in about ten days, and up to the last molt has all the habits of an ordinary Cut-Worm, the colors being much paler than when full grown, and the worm hiding during the day at the base of the grasses. When not excessively

numerous they retain this their normal Cut-Worm habit, and only when they become excessively multiplied do they acquire the marching and migrating habits.

REMEDIES.

Experience has established the fact that burning over a meadow, or prairie, or field of stubble, either in winter or spring, usually prevents the worms from originating in such meadow or field. Such burning destroys the previous year's stalks and

[Fig. 75.]



Army Worm Moth:—*a*, end of abdomen denuded and showing ovipositor at rest; *b*, same with ovipositor fully extended; *e*, *f*, retractile subjoints; *h*, eggs—all enlarged; *g*, eggs, natural size (after Riley).

blades and, as a consequence of what we have already stated, the nidi which the female moth prefers. Burning as a preventive, however, loses much of its practical importance unless it is pursued annually, because of the irregularity in the appearance of the Worm in injurious numbers. Judicious ditching, *i. e.* a ditch with the side toward the field to be protected perpendicular or sloping under, will protect a field from invasion from some other infested region when the worms are marching. When they are collected in the ditch they may be destroyed either by covering them up with earth that is pressed upon them, by burning straw over them or by pouring a little coal oil in the ditch. A single plow furrow, six or eight inches deep and kept friable by dragging brush in it, has also been known to head them off.

From experiments which we have made we are satisfied that where fence-lumber can be easily obtained it may be used to advantage as a substitute for the ditch or trench, by being secured on edge and then smeared with kerosene or coal tar, the latter being more particularly useful along the upper edge. By means of laths and a few nails the boards may be so secured that they will slightly slope away from the field to be protected. Such a barrier will prove effectual where the worms are not too persistent or numerous. Where they are excessively abundant they will need to be watched and occasionally dosed with kerosene to prevent their piling up even with the top of the board and thus bridging the barrier. The lumber is not injured for other purposes subsequently.

SUMMARY.

We conclude with the following summary of the natural history of the Worm as given in the 9th Mo. report above referred to:

"The insect is with us every year. In ordinary seasons, when it is not excessively numerous, it is seldom noticed: 1st, because the moths are low, swift flyers, and nocturnal in habit; 2nd, because the worms, when young, have protective coloring, and, when mature, hide during the day at the base of grasses. In years of great abundance the worms are generally unnoticed during early life, and attract attention only when, from crowding too much on each other, or from having exhausted the food supply in the fields in which they hatched, they are forced, from necessity, to migrate to fresh pastures in great bodies. The earliest attain full growth and commence to travel in armies, to devastate our fields, and to attract attention, about the time that winter wheat is in the milk—this period being two months later in Maine than in Southern Missouri; and they soon afterwards descend into the ground, and thus suddenly disappear, to issue again two or three weeks later as moths. In the latitude of St. Louis the bulk of these moths lay eggs, from which are produced a second generation of worms, which become moths again late in July or early in August. Exceptionally a third generation of worms may be produced from these. Further north there is but one generation annually. The moths hibernate, and oviposit soon after vegetation starts in spring. The chrysalides may also hibernate, and probably do so to a large extent in the more northern States. The eggs are inserted between the sheath and stalk, or secreted in the folds of a blade; and mature and perennial grasses are preferred for this purpose. The worms abound in wet springs preceded by one or more very dry years. They are preyed upon by numerous enemies, which so effectually check their increase, whenever they unusually abound, that the second brood, when it occurs, is seldom noticed; and two great Army Worm years have never followed each other, and are not likely to do so."

THE PERIODICAL CICADA.

Riley 1880

SEVENTEEN- AND THIRTEEN-YEAR BROODS.

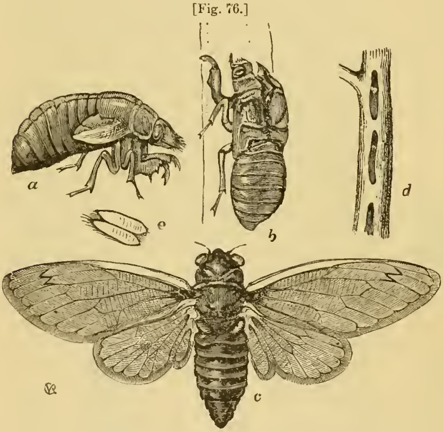
We quote the following from our First Report on the Insects of Missouri:

BROOD XV.—*Septemdecim*—1863, 1880.

In the year 1880, and at intervals of 17 years thereafter, they will, in all probability, appear from Western Pennsylvania to Scioto River, east, and down the valley of the Ohio River, as far as Lewis County, in Virginia.

This brood is recorded in Ohio as far back as the year 1812, by "A. M. B.," writing to the Chicago *Tribune*, under date of June 22, 1868. Harris also records its appearance in Ohio in 1829, and they were quite numerous in Coles County, in the centre of the same State, in 1846. or during the first year of the Mexican war, while Dr. Smith records it in the eastern part of the State, extending over twelve counties, west, to the Scioto River, and to Sandusky, on Lake Erie, in 1829, '46 and '63; and in Lewis County, Virginia, since 1795. As before stated, this brood occurred in Ohio in 1846, simultaneously with the *tredecim* Brood VII in South Illinois. Dr. Fitch, in his account of

[Fig. 76.]



THE PERIODICAL CICADA: *a*, pupa, side view; *b*, pupa shell; *c*, mature insect, with wings expanded; *d*, twig, with egg-slits—nat. size; *e*, eggs—enlarged (after Riley).

his 5th brood, also records its appearance, and states that it reached to Louisiana. But just as the *septemdecim* Brood VIII was confounded with the great *tredecim* Brood XVIII in 1855, so this *septemdecim* Brood XV was doubtless also confounded with it in 1829, for they both occurred that year. Had the western country been as thickly settled in 1829 as it was in 1855, the *tredecim* Brood XVIII could undoubtedly have been traced in Southern Illinois and Missouri, etc., in the former as it was in the latter year. This belief is furthermore greatly strengthened from our having no other record of the appearance of this *septemdecim* brood, in Louisiana, than Prof. Potter's statement that they appeared there in 1829, whereas they have occurred there since 1829, at intervals, not of 17, but of 13 years, and were there the present year, 1868, as will be seen on referring to Brood XVIII. The dividing line of these two broods (XV and XVIII) is probably the same as with broods VIII and XVIII.

The papers have generally noticed the appearance of these insects in the parts of Ohio indicated, and also in Western Pennsylvania. Among the different items that have come to our notice, we quote the two following as samples:

Among the other events that thickly crowd this eventful summer is the advent of the seventeen-year locust. It reappears in the southern counties of Ohio, and in consideration of the locality its coming must have some political significance. In 1812 the great W on its wings stood for "war," and in 1863 it stood for "war" again. What it signified in the intervening years when there was no war cloud on the horizon, I do not know. With a judicious variation of this initial letter the locust might, especially on Presidential years, become a new force in politics. But it is again the same great W.—Washington (D. C.) *Republic*.

The seventeen-year locust is filling the hills and rich bottom-lands of Western Pennsylvania and Virginia with its droning thunder, which is almost deafening at noon on a sunny day. The farmers have plenty of reasonable theories to account for its mysterious appearance and long absence. It has, they say, to make a journey to China and back, which takes eight years each way; or, it is a part of the Egyptian host, lost in the Red Sea, which still live in some nether world but are allowed every seventeen years to revisit these glimpses of the moon, and cry on Phar-a-oh! Pharaoh! to arouse the remorse of their buried leader; or, it comes to foretell war, as may be seen by the most incredulous in the W on its wing. But the sole outcome of all these impending disasters will be a downfall of dead limbs in August. This locust eats neither fruit nor vegetable, so far as can be discovered; it simply riddles the green new wood of the tapering limbs of trees to deposit its eggs. If these branches are burned and the ground plowed up, our visitor will be longer in making his journey from China or the Red Sea.—N. Y. Weekly *Tribune*, June 7, 1880.

Mr. William H. Edwards, of Coalburgh, writes that it has appeared in his section of West Virginia. We will not now recapitulate the many interesting facts connected with this insect which have been recorded by ourselves and others, but we ask our readers to help us to perfect our knowledge of the extent and geographical range of this brood, by sending us any facts that have come to their knowledge as to the particular locations in which it has this year appeared.

We further quote from our chronology of this insect as follows:

BROOD XVI.—*Tredecim*—1867, 1880.

In the year 1880, being the same as the preceding, they will, in all probability, appear in the north part of Cherokee County, Georgia, having appeared there, according to Dr. Smith, in 1828, '41, '54, and, according to Dr. Morris, in 1867. This brood occurred in 1867 simultaneously with the northern *Septemdecim* Brood XXI.

We have not yet observed any notice of the reappearance of this brood in the part of Georgia mentioned, and shall be glad to get corroboration of the accuracy of Dr. Smith's and Dr. Morris's observations.

BORER PREVENTIVE.

"One pint of crude carbolic acid, costing 25 cents, is sufficient for twenty gallons of soft soap, with as much hot water to thin it; then stir in the pint of carbolic acid and let stand over night or longer to combine. Now add twelve gallons rain water and stir well; then apply to the base of the tree with a short broom or old paint brush, taking pains to wet the inside of all crevices. This will prevent both peach and apple borers. It should be applied in the latter end of June in this climate, when the moth and beetles usually appear."—*Farmers' Advocate*.

The above described composition might prevent the female beetle of the Round-headed Apple-tree borer (*Saperda candida* Fabr.) or the moth of the Peach-tree borer (*Ægeria exitiosa*) from depositing her eggs on the bark while coated with it; but to be at all effective the application would have to be frequently renewed, especially if used to keep out the Peach-tree borer, as the moths of this pest are about nearly the entire summer.

To prevent the attacks of the Flat-headed Apple-tree borer (*Chrysobathris femorata*) the larger branches as well as entire stems of the trees must be coated and kept in that condition throughout the growing season, as this insect works principally among the branches of the trees, and is usually more abundant late in summer than early in spring. We have no doubt of the value of the above composition for the purpose, but a single application in a season would scarcely be sufficient to keep out any of the species of borers named.—A. S. F.

FOOD-HABITS OF GROUND-BEETLES.

BY F. M. WEBSTER, WATERTOWN, ILL.

My researches with respect to the food-habits of some of our common species of Coleoptera, are proving more interesting than I had reason to expect, thanks to Prof. Forbes of the State Lab. of Nat. Hist.

For years I have been a close observer of the ways of insects, and have often noticed them eating substances not at all in accordance with the ritual which entomologists have prepared; but having little reputation as a naturalist, felt somewhat timid about publishing these observations without more proof than my own investigations. The discovery by Prof. Forbes that he could detect vegetable food in the stomach of insects, has given me the long-sought opportunity.

So far this season we have found two of our so-called strictly carnivorous beetles to use a mixed diet, viz., *Harpalus herbivagus* Say—the third of this genus which I find to be partially phytophagous—and *Megilla maculata* DeG., found devouring the pollen of the Dandelion (*T. dens-leonis* Lers). The Professor finds the stomach of this species "literally packed with pollen."

It seems to me it would be a good plan to call the attention of entomologists to the food of our common insects, as we seem to be reaching a stage where we must know for a certainty whether or not they might become injurious in case of an over-production caused, perhaps, by an over desire on the part of men to protect them.

In short, I can not see how we are to estimate the value of our insectivorous birds and animals without knowing precisely the value of the insects which they destroy. Which is far from being the case.

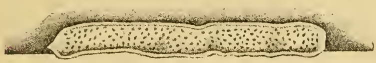
USE OF GUANO FOR GRAPE PHYLLOXERA.—At a recent meeting of the Paris Academy of Sciences Dr. Hamm advised the application of sulphide of carbon with infusorial earth or guano as an absorbent, believing that more of the sulphide can thus be applied without injury to the roots, and that evaporation will thereby be lessened.

NOTES ON THE EGGS AND LARVÆ OF AN UNKNOWN DRAGON-FLY.

BY W. R. GERARD, NEW YORK.

In the month of July, 1878, while rowing on a small lake at Willowsmoe, on the Southern Catskills, my attention was attracted by a number of long gelatinous egg-masses of some animal unknown to me, and which were attached, in bunches of from 30 to 40, by one of their extremi-

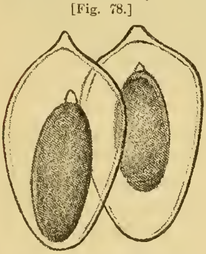
[Fig. 77.]



Small portion of Egg-mass of Dragon-Fly, probably DIPLAX (after Gerard).

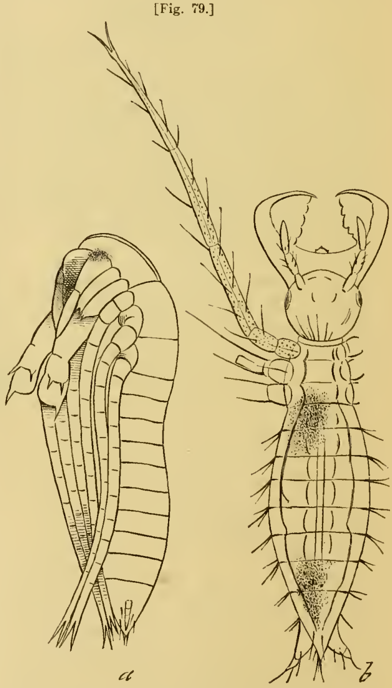
ties, to the stems of *Potamogeton*, and floating horizontally near the surface of the water. Each string (Fig. 77) was cylindrical; about one-eighth of an inch in diameter; 12 to 15 inches long; opalescent by reflected and transparent by transmitted light; and, being continuous throughout its whole length, was apparently the product of a single individual. There was such a difference in the state of development, however, of the eggs taken from the same or different parts of the string as to make a subsequent chronological study impossible. The yelks, broadly elliptical in outline, and pale yellow in color, were each inclosed in a hyaline ovoid membrane, which was apiculate at its broad extremity (Fig. 78). The eggs were placed at such an angle in the mass as to cause their broad ends to point outwards and towards the free end of the string. As nearly as I could count, there were about 500 eggs to the inch. Being ignorant of what I had to deal with, I assumed, from analogy merely, that these egg-masses were the product of some batrachian allied to the toad. On visiting the locality very early the next morning after the discovery, I was surprised to find that the strings had all disappeared from sight; but later in the day, when the sun was high, and the water warm, I found them again, floating as before. It seems that at night the strings sink and hang vertically alongside of the plant to which they are attached, and are thus hidden. I could not ascertain the cause of this phenomenon, although I observed it frequently thereafter; but it is certainly a wise provision of Nature to ensure of the eggs in the whole extent of the string receiving the full rays of the sun. I brought one or two of the strings home with me, intending to study the development of the as yet unknown animal, *ab ovo*, and for this purpose put them in a large tumbler of water in my window, where they received the rays of the sun. Owing to the fact, as above stated, that the eggs were

[Fig. 78.]



DRAGON-FLY eggs, enlarged (after Gerard.)

[Fig. 79.]



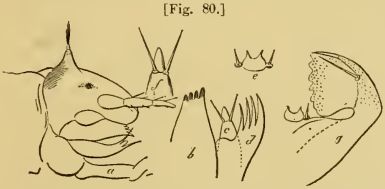
DRAGON-FLY LARVA: , *a*, just before escaping from gelatinous surrounding; *b*, just after escaping, all legs but one detached (after Gerard).

found to be in very different states of development, I could not ascertain each successive stage accurately; but I have made drawings of many of the different states, which I may at some future time use if I can succeed in determining the species.

Through the vigorous efforts of the larva, when ready to hatch, the membranous covering of the yelk ruptures longitudinally, its edges curling inward, and the insect emerges limp and apparently lifeless, and lies for some time nearly motionless (in the state shown in Fig. 79, *a*) in the surrounding gelatine. Gaining strength, however, it makes its way out of the mass and begins to swim actively about (Fig. 79, *b*).

This whole development closely resembles that of a species of *Diplax* as studied

[Fig. 80.]



HEAD-PARTS OF DIPLAX (?) LARVA: *a*, base or pedicel of labium; *b*, mandible; *c*, *d*, labial palpi; *f*, same as *c*; *e*, ligula?; *g*, second maxillæ or labium (after Gerard).

by Prof. Packard, and figured and described in his "Guide to the Study of Insects"; and it is quite likely that the eggs and larva which I have described belong to some species of that, or some closely allied genus. I am led to this conclusion from the structure of the mouth-parts, and the presence of the formidable mask (Fig. 80, *a*), which is peculiar to the young of the Dragon-fly. My efforts to rear the larvæ were unsuccessful, and I succeeded in keeping them alive for about a week only, probably from my ignorance of their habits and of the food necessary to them.

FERTILIZERS OF ALPINE FLOWERS.—Mr. Hermann Müller of Lippstadt, Germany, stated some years ago in *Nature*, that the Lepidoptera are far more frequent visitors and fertilizers of flowers in the Alps than in the lower land, and that from this cause in the former locality more flowers are adapted to cross-fertilization by Lepidoptera than in the latter. In the same periodical (No. 534, Jan. 22, 1880, p. 275) he gives now, as corroborating his statement and as a preliminary result of observations continued through six summers, a table showing the number of visits of insects to flowers, observed by himself and arranged according to the different species of insects and different species of plants, in the Alps, compared with such visits in the lower land. A second table which we reproduce herewith shows the proportion of insects in different orders and at different altitudes, out of 1000 different visits of insects to flowers (differing either by the species of flower or by the species of insect):

	1. In the lower land.	2. In the Alps generally.	3. Above the boundary of trees.
Coleoptera,	89.66	.59	48.22
Diptera,	305.49	324.93	334.65
Hymenoptera,	525.71	241.95	186.76
Lepidoptera,	69.77	371.50	428.31
Other Insects,	9.37	2.62	2.16
	1000.00	1000.00	1000.00

The great preponderance of such visits of the Lepidoptera in the Alps, and especially above the timber line, is quite striking.

ECONOMIC ENTOMOLOGY IN THE PUBLIC SCHOOLS.—The only way to bring this practical science to agricultural minds generally, to the class with whom it is of greatest importance, is, to require that it be taught in all the public schools. It is a kind of knowledge which the young country student grasps easily and successfully when deprived of its unessential technicalities. Of such practical consequence is it that it had better be taught even at the expense of almost any other study of the usual courses, and some attention to it would be a great relief from unnecessary problems in abstractions which are often inflicted to a useless extent in early training.

It is a sad consequence of the failure to teach natural science in the public schools that our cultivators do not recognize their

own interest and duty with reference to insects, and need to be forced by law to a sense of its importance. Words persuade, but examples convince. Let every intelligent farmer help demonstrate it for the good of himself and others.—W. S. B.

CARNIVOROUS HABITS OF CADDIS-WORMS.—Mr. G. C. Goody records the observation, in a recent number of *Science Gossip*, that Phryganeid larvæ occasionally feed on fish eggs and upon a spider, while he has fed several upon beef and mutton. The food of these insects is normally vegetarian, and the facts mentioned by Mr. Goody find correspondence in many other species normally plant-feeding, but which, when opportunity offers or necessity obliges, become carnivorous or even cannibalistic.

It appears from the last official report that at the end of the last year, in forty-three departments in France affected by the Phylloxera, 1,773,154 acres of vines were quite destroyed, and 317,760 partially injured. The east, west, south and center are ravaged, and the north is menaced. The disease has reached Cote d'Or, and will soon be in Champagne and Lorraine. If no remedy is discovered, it is calculated that in sixteen years France will have no vines left. It is among the probabilities that America will ere long be the wine producing country of the world.—*Farmers' Review.*

Mr. Seth Green says that one morning when he was watching a spider's nest, a mud-wasp alighted within an inch or two of the nest, on the side opposite the opening. Creeping noiselessly around toward the entrance to the nest, the wasp stopped a little short of it, and, for a moment, remained perfectly quiet. Then reaching out one of her antennæ, she wriggled it before the opening, and withdrew it. This overture had the desired effect; for the boss of the nest, as large a spider as one generally sees, came out to see what was wrong, and set it to rights. No sooner had the spider emerged to that point at which he was at the worst disadvantage, than the wasp, with a quick movement, thrust her sting into the body of her foe, killing him easily and almost instantly. The experiment was repeated, on the part of the wasp; and when there was no response from the inside, she became satisfied, probably, that she held the fort. At all events, she proceeded to enter the nest and slaughter the young spiders, which were afterwards lugged off one at a time. —*Grange Bulletin.*

DEVELOPMENT OF THE EYES AND LUMINOSITY IN THE FIRE-FLIES.—Mr. H. S. Gorham of Shipley, England, has called attention to the development of the eyes, especially in the males, in direct proportion to the luminosity of the species, and to that of the female when that sex has the greatest luminosity. The plumosity or flabellation of the antennæ is on the contrary in the inverse proportion, that is to say, these genera in which the antennæ are plumose in the male, usually have small eyes. Where the eyes are large in both sexes, both sexes are luminous and the male perhaps most so, and both are furnished with wings. Where the female is especially the luminous sex, she is frequently unable to fly, and it is here that the eyes in the males attain the largest development.

GRAPE PHYLLOXERA NOT AT THE CAPE. —It would seem that the panic among some of the Cape Colony wine growers in regard to the work of Phylloxera on their vines was premature and unwarranted, as an examination of the roots of the unhealthy vines by Mr. R. A. McLachlan and Mr. Roland Trimen of Cape Town showed that all the characteristic signs of Phylloxera-work were wanting. The importance in such cases of an examination by competent entomologists can not be too strongly urged, because vines are well known to suffer and die from other causes, which are too apt to be mistaken for Phylloxera-work by those unfamiliar therewith.

The fruit growers of California want a law that will oblige bee-keepers to keep

their bees at a prescribed distance from orchards and vineyards.

We note, from the *Pacific Rural Press*, that the following bill has been introduced in the Assembly by Mr. Adams of Sonoma, providing for the extermination of insects in orchards and vineyards :

The Board of Supervisors in the several counties of this State are hereby authorized and required, when application is made in writing by five legal voters of any voting precinct in the county, to appoint a commission of such number as they shall deem necessary, to inspect fruit trees and vines within the district for which they shall have been appointed, and in case disease of any kind be found among said trees or vines, or anything detrimental to the growth and prosperity of such trees or vines, said commission may order such action taken for the removal of such vines, or otherwise, as they may deem necessary for the public good ; provided, that such commission shall serve without compensation, and the labor necessary to comply with their recommendations shall be at the expense of the owner of the property.

The last provisions will certainly render the law nugatory.

We are gratified to be able to state that Congress appropriated $25,000 for completing the work of the U. S. Entomological Commission, under the Interior Department. For the first time since the creation of the Commission the full appropriation asked for in the estimates has been made, and we doubtless owe this success in some measure to the persistent opposition of General W. G. LeDuc, Commissioner of Agriculture, and Prof. J. Henry Comstock, the Entomologist of said Department. We find no fault with General LeDuc for his attempt to divert the appropriation to his Department, though we have no sympathy with the methods he employed in his endeavors. Of Mr. J. Henry Comstock's conduct in this connection we may have further occasion to speak. The course of these gentlemen is sufficiently condemned in the fact that they have been frustrated in their efforts.

Our Book Notices and acknowledgments are this month crowded out.

Errata.—Page 156, col. 2, line 4, insert a comma after "genus."

EXTRACTS FROM CORRESPONDENCE.

Pronuba vs. Prodoxus.—I have been much interested in your remarks in the last number about *Pronuba*, etc. I described *Hyponomeuta 5-punctella* from 8 captured specimens received from Mr. Belfrage, in which I found no variation. The larva and its habits being unknown I referred it to *Hyponomeuta*, as I detected no points of difference from that genus which I deemed of generic value. Under the same circumstances I should still refer it to *Hyponomeuta*, but the larva and habit described by you make such a reference clearly improper. If, therefore, your *Prodoxus decipiens* is identical with my *H. 5-punctella*, as you state—and which I have not now the means of determining for myself—you are very certainly right in defining for it the new genus *Prodoxus*. As to the specific name *decipiens* (if it is the same species as *5-punctella*), it is (since you find the species so variable) certainly more appropriate than *5-punctella*, since it seems not only to have, one way or another deceived me, but you also, as well as Mr. Boll and Dr. Hagen. If, therefore, the species are the same, it should be called *Prodoxus decipiens*, unless the specific name *paradoxica*, suggested for it by me in the paper in the Cincinnati Journal, takes priority over *decipiens*.

Approaching so nearly as your *P. decipiens* does to *Pronuba yuccasella*, according to your account, I have no doubt that my Colorado specimens found in Yucca flowers and in company of *P. yuccasella*, were that species ; and the larva and its habits being then unknown, it was more natural and reasonable for me to suppose that *yuccasella* was sometimes spotted, than that I had before me another species so closely allied to it in structure, ornamentation, and habitat; and therefore I probably did not examine the specimens carefully enough to detect the difference. At any rate, your discovery shows that I was right in arguing, in the Cincinnati paper, from the habits, habitat, etc., of the specimens, that if it was not *Pronuba* it could not be *Hyponomeuta*. As you suggest (*in lit.*), we both are right and both are wrong. I must differ from you, however, as to *Pronuba* and *Prodoxus* belonging to the *Tineidæ*. I consider them as connecting the *Tineidæ* and *Hyponomeutidæ*, to which latter family I believe Prof. Zeller refers *Pronuba*.—V. T. Chambers, Covington, Ky.

[We entirely agree with all that Mr. Chambers says, even to the statement that *Prodoxus* and *Pronuba* connect the *Tineidæ* and *Hyponomeutidæ*. But such osculant forms are always turning up, and unless the characters are sufficiently striking and unique to warrant the formation of a new Family, it is always best to place the species in that family with which they have greatest affinity and most resemblances. As to the specific name *decipiens*, the future catalogue-maker or list-maker if he be a stickler for priority, will be warranted in retaining the name of *5-punctella* Cham., however misleading it may be, and considering *decipiens* a good variety name for the immaculate form. The further facts we add in this number will show that the deceptive points of general resemblance which *Prodoxus* bears to *Pronuba*,

are all the more remarkable considering the many more important structural differences that exist between them.—Ed.]

Experience with the Imported Cabbage Worm.—I would like to make observations on the Cabbage Worm this year, and wish to get all the light I can that will help me in my study. I grow from 3,000 to 5,000 early cabbage and from 17,000 to 25,000 late cabbage, each year. During 1878 I had one flat of two acres of extra fine cabbage on a clover and timothy sod. Most of it was manured with stable-manure one year, the next year with a coat of (heavy) ashes, and the following winter a heavy coat of Tankage from the slaughter and packing house (heads, feet, etc., steamed). In the spring the sod was plowed and planted to cabbage.

The result was an immense crop. The butterflies were very numerous the whole season, and fears were expressed that I should have no cabbages, on account of the worms. The crop, however, received very slight damage from the worms, except on the outsides of the patch to the sixth or tenth row in. When selling in the Fall, a customer called my attention to the chrysalis on the cabbage, which, upon being opened, showed something that looked like maggots, so that I think there is a parasite at work.

We have observed that large patches receive much less injury than small ones. It is very rarely that cabbage is raised with any success in small patches.

I stated, at the Indiana State Horticultural Meeting, that if we manure heavily, cultivate thoroughly, and grow in large patches, we can raise cabbage.

Gov. Furnas remarked that we ought to keep them off the outsides of the patches also. This is the point on which I am anxious to be informed; hence would like to aid you and the other noble investigators to find out how it is to be done.

From what I can learn, the hot-water process (lime, pepper, coal-oil,) have proven a failure, at least partially so; and to catch the worms or butterfly is a big job.

In our city an Irishman raised a splendid crop of cabbage by sprinkling the plants with a decoction of May-apple-root. If this last remedy is successful, it is one that can be easily obtained, at least in the West.—H. C. Marsh, Muncie, Ind.

Seventeen-year Cicada in Pennsylvania.—The "seventeen-year locust" has made its appearance here again this year, and as I learn that you have given much attention to the natural history, etc., of this species of the Cicada, you will place me under many obligations by giving me a reference to your own publications, and such other information as is attainable on this interesting subject.—F. C. Robinson, M. D., Uniontown, Pa.

[Our most extended article on this insect appeared in the first Report (1868) on the Insects of Missouri. It is hard to obtain, but it is advertised by Mr. E. P. Austin, 46 E. Newton St., Boston, Mass.]

Notes on Gall-making Pemphiginæ from France.—I follow closely my Poplar gall-lice. Their eggs hatched about 10 days ago. I put the young ones on little trees planted at my door, to follow them daily. They have already formed their little galls. I had, also, good success in breeding *Schizoneura corni*, and I am nearly sure, as I know the food-plant (grass roots) of the "*gemmous*" phase, to follow this year the whole cycle of this species. The only form I do not yet know is the "*emigrant*," and as I have already the stem-mother producing her young ones, I hope in about a fortnight or so to get the winged females. The species, according to its stage of life, has been described under three, and perhaps four names:

1. Stem-mother, } = *Anœcia corni* Koch (Fabr. sub. *Aphis*).
2. Emigrant, }
3. Gemmous = *Amycla fuscicornis* Koch } *Pemphigus boyeri* Passerini.
4. Pupifera = *Schizoneura vagans* }
5. Sexuated = *Schizoneura corni* Kaltenbach (who described them as the autumnal young, without knowing their real nature).

—J. Lichtenstein, Montpellier, France, April 3, 1880.

Eggs of Corydalus cornutus.—Hearing some doubt expressed as to the correctness of your conclusions as to the eggs and early development of *Corydalus* as set forth in your paper before the Am. Ass. for Adv. of Science, I think you will be glad to know that I have observed the same on specimens I collected and developed for a short time here last summer, corroborating your work, except that here the egg-masses are deposited on the vertical sun-exposed faces of rocks over the water instead of on leaves. The hatching-dates here were during the last half of August.—W. S. Barnard, Ithaca, N. Y.

[Those who have read the abstract of our second paper on this subject, read at the St. Louis (1878) Meeting of the Association, will not longer question the accuracy of our conclusions.]

Pyrethrum for Grain Weevils.—Adjacent to my office is a warehouse filled with wheat. This spring the Grain Weevils therein commenced to migrate, and infested my premises. We, therefore, sprinkled some Buhach or Insect-powder over the grain, and swept the weevils up literally by the quart. Those which emigrated to my office were also treated with a sprinkling, and it cut short their earthly career. * * *

I am convinced that a judicious use of this powder on board each grain-ship would save an immense amount of loss. I have seen it used in one of the largest mills in the State, and it brought cockroaches out in quantities which astonished even the miller, who little thought he had so many on his premises. A clergyman, a friend

of mine, who cannot sleep if a mosquito is within a mile of him, tells me he has only to put a little powder on some burning paper in his room, and there is "perfect peace."—A. T. Elliott, Stockton, Cal.

Interesting Cotton Worm Notes from Vera Cruz, Mexico.—In this Consular District about 8,000,000 lbs. are produced. The peculiarities of culture are striking. The ground is prepared by removing rubbish, and then the seed is planted by inserting a sharp stick in the ground at convenient intervals; into the holes thus made the seed is deposited and covered by the foot. No plows are used in this preparation for the seed, nor are they often used in the subsequent stages of cultivation. They pull out the larger weeds or use the hoe, confining their labor to little more than such. It is clear from that kind of culture that the cotton plant must be forced into much bad company, and be assaulted with destructive enemies. After extensive inquiries I find no one scientifically informed on the full habits of these enemies.

* * * * * *

It is a hotly disputed point as to what becomes of the worm during the "six or eight years" when it does not appear, and no one in my circuit of acquaintance gives me anything better than a superstition for a solution of the problem. Our climate, never giving us frost, scarcely affects the constant germinal qualities of plants or the enemies thereof, and it has been asserted to me that at one place or another the Cotton Worm can always be found. However, the difficulty I have experienced in obtaining the specimens sent, induce me to doubt the correctness of that assertion.

* * * * * *

The worm has been here as long as cotton has been cultivated by the Mexicans.

We have historical accounts that cotton was grown and utilized since the twelfth century, but have no data that it was or was not naturally indigenous. But if said history be reliable it is fair to presume that it was indigenous, because there is no knowledge of commercial relations with foreign countries at that period.

* * * * * *

The winds here are Easterly and South-easterly. —S. T. Trowbridge, U. S. Consul, Vera Cruz, Mexico, March 3, 1880.

I send you a bottle containing various kinds of worms that destroy the cotton and plant. They are all I have been able to procure. This is now the part of the year in which the worms usually appear, and they have been gathered near San Andres Tuxtla, on the Southern coast from here.

* * * * * *

On the coast they are called *palomas* (moth) or *salomilla* (chrysalis or aurelia). Said paloma is ash-color, and is nocturnal in its habits. The moth produces a multitude of microscopic eggs on the plant, which eggs create the worm, also microscopic, and which commences immediately to devour the plant, and so continues until it gets to the state of enrolment, in order to pass through the last metamorphosis. I have not been able to obtain sufficient data to say whether they were imported into this country, but I am assured that they do not make their appearance every year at the same place, or better said, they only come one or two years in succession, then disappear for six or eight years. They are not to be found in all the country at one time. Their reproduction is usually ascribed to our southern coast.

* * * * * * * *

I understand their invasion can be victoriously combated by sprinkling dry chloride of lime over the ground and plants, or an aqueous solution of the same, and I have recommended this remedy to those living on the coast for a trial.—R. de Zayas Enriquez, Vera Cruz, March 2, 1880.

[The worms sent by Signor Enriquez are the genuine Aletia of all sizes, but mostly full-grown. The facts communicated in the above reports are most interesting, not only on account of the remote period to which the growth of cotton may be traced on this continent, but also because of the general observations as to the re-occurrence of the insect in injurious numbers at irregular periods only. In other words, the insect presents the same phenomena in Mexico as in this country, and the same facts upon which the theory of annual immigration to the United States have been largely based, will hold equally true of a country essentially below the frost line. This all goes to prove the correctness of our conclusions that the absence of Aletia during certain years is apparent only, and that its undue multiplication during other years is paralleled by similar phenomena in respect of many other insects, and notably of the Northern Army Worm, the apparently sudden appearance and disappearance of which over vast regions is even more marked than in the case of Aletia. Yet, as we have shown in the case of both these insects, they may always be found in limited numbers even when their presence is not suspected.]

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

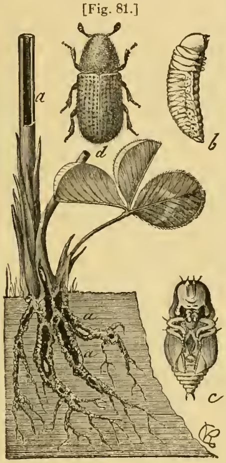
Clover-root Borer.—I send you, by the mail that carries this, a small box with a few Clover-beetles in it, which, if I remember correctly, are the same as you described about a year ago. I shall be greatly obliged to you if you will give the scientific name, together with information as to where I can find a description and history of the beetle. It has ruined eighteen acres of Clover on the University farm, and is actually to be found in every clover plant on the campus. I have

examined about a hundred plants taken at random, and find from two to five beetles in each. The plants have made but a small growth, and are beginning to wilt under the hot suns.—W. A. Henry, Ithaca, N. Y., May 23, 1880.

The insect is the Clover-root Borer (*Hylesinus trifolii* Müller, Fig. 81), first treated of in our Report to the Department of Agriculture (1878), from which we quote in answer to our correspondent's questions :

I have found the insect in all three stages of larva (see Fig. 81, *b*), pupa (*c*), and adult (*d*), up to the time of frost, though the perfect beetles at this season very greatly predominate. The insect hibernates in any of these three stages, and continues propagating as soon as spring opens, the beetles issuing from the ground and pairing during the early spring months. The female then instinctively bores into the crown of the root, eating a pretty large cavity, wherein she deposits from four to six pale, whitish, elliptical eggs. These hatch in about a week, and the young larvæ at first feed in the cavity made by the parent. After a few days, however, they begin to burrow downward, extending to the different branches of the root. The galleries made in burrowing run pretty regularly along the axis of the roots (Fig. 81, *a*, *a*, *a*), and are filled with brown excrement. The pupa is formed in a smooth cavity, generally at the end of one of these burrows, and may be found in small numbers as early as September.

[Fig. 81.]



CLOVER-ROOT BEETLE.—*a*, *a*, *a*, bored stem and roots—nat. size; *b*, larva; *c*, pupa; *d*, beetle—enlarged (after Riley).

It is the custom in Western New York to sow the Clover in spring on ground already sown to fall wheat. This is generally done while the snow is yet on the ground or while the frost is disappearing, one peck of seed being used to the acre. The Clover is allowed to go to seed in the Fall, and usually produces but little. During the second year one crop of hay and a crop of seed are obtained. It is during this second year that the injury of the Hylesinus is most observed.

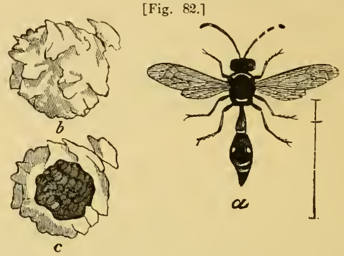
No experiments have yet been made with a view of preventing the injuries of this clover pest, and no other mode of prevention suggests itself to my mind than the plowing under of the Clover in the spring of the second year, if the presence of the beetle is observed.

The length of the beetle averages about 2.5^{mm}.

Mud Wasp and Spider Egg-Nest.—I inclose two little empty mud cells which I took from the evergreen hedge which surrounds my "insect menagerie"—figured in Harper's for May [1]. Also a curious little basket-like cocoon that I took from a twig. I am inclined to think this the work of a spider, but Dr. McCook thinks it the work of some Hymenopter. I pulled a quantity of silk from the hole, which clearly showed that tiny spiders had been the occupants, but McCook says a spider might have availed itself of the old cell to rear its young. But how could a spider large enough to fill the cavity with silk and eggs get into such a small hole? [2].—M. T., Vineland, N. J.

The mud cells are those of the fraternal wasp (*Eumenes fraterna* Say) which has the interesting

[Fig. 82.]



EUMENES FRATERNA : *a*, ♀ wasp ; *b*, cell ; *c*, do. cut open (after Riley).

habit of storing its cell with the destructive Spring cankerworm (*Paleacrita vernata*, Peck), though it doubtless makes use of other green worms as well. We illustrate one of these cells at *b*, the same cut open at *c*, and the wasp that makes them at *a*.

[Fig. 83.]

Pendulous Egg-nest of Spider.

There is no question in our mind but that the pretty little basket-shaped, dark-gray cocoon (Fig. 84) is that of some spider, but of what particular species we cannot say, though it probably belongs to some common species of the *Epeira*. We have in our cabinet one bearing close resemblance to it in size and color, but suspended from the limb as at Fig. 83, and we have others that are suspended with a girth like that which you send, the girth, however, being much more loose, and the cocoon having in one instance a tail and in the other not.

[Fig. 84.]

Basket Egg-nest of Spider.

We are inclined to look upon all three of these cocoons as modifications made by one and the same species.

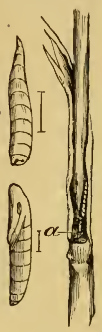
Worm in joints of Wheat.—Herewith are some sections of wheat-stalks, in the joints of which you will find a small worm. Nearly or quite every stalk seems to be affected with them ; as a consequence, the straw is inclined to fall before the wheat is fully ripe.

Will you kindly investigate and inform me in

return what they are? I have an idea they result from the operations of the Hessian-fly.—J. K. P. Wallace, Andersonville, Tenn.

There are various small worms infesting the stems of wheat in this country and bearing a close resemblance to that which you send, but they are genuine maggots and produce small two-winged flies. One of them, known as the American Meromyza (*Meromyza americana* Fitch) is more particularly injurious, and the accompanying figure (Fig. 85) will show its form and manner of working, at *a*; the form of the maggot at *b*, and the pupa to which it changes at *c*. Your worm has, however, a different structure, and belongs to another order, being apparently Hymenopterous. It is quite new to us, and we will endeavor to rear the perfect insect. No remedy of a practical nature can be suggested at this time. The worms have no connection with the Hessian-fly.

[Fig. 85.]



MEROMYZA AMERICANA: *a*, work of maggot—nat. size; *b*, maggot; *c*, pupa—enlarged (after Riley).

Linden and Ash destroyers.—The Linden-beetle made its first appearance here this year on May 20th, in great numbers. Have observed copulation from the first, but the larva, if any, have escaped my scrutiny. I inclose sample of leaves and beetles [1].

The inclosed chrysalis are of large worms seen feeding on the Linden leaves. They continued to eat freely in captivity [2].

I also inclose a specimen of a very large beetle or borer that have destroyed two fine trees upon my lawn, of the native Poplar, or, as it is sometimes called, the Trembling Aspen. They perforate the trunk midway up amongst the branches, when the top dies or is broken off by the wind [3].

Many here attribute the wide spread destruction of the Black Ash forests to leaf worms, a sample of whose web nest I last autumn sent you, and regard the Root-borer as a sequence rather than a cause.—Shelby Reed, Scottsville, N. Y.

[1] The species on the Linden is *Odontota rubra* (Web.). We do wish you could manage to find the eggs, and if the beetles have been noticed *in copula*, we think you could succeed with a little care. We are very desirous of learning just how the eggs are laid, and just what they look like.

[2] The chrysalides are those of the Fall Web Worm (*Hyphantria textor*).

[3] The borer from native Poplar is *Saperda calcarata* Say, an insect which, as indicated on p. 161 of this volume, is very destructive to the Cottonwood throughout the West. The destruction of your Black Ash is certainly more due to the Root-borer than to the Web Worm above referred to, though what particular beetle the borer will produce we do not yet know—probably *Neoclytus caprœa* Say.

Blister-beetles Wanted.—The Secretary of the Smithsonian has been good enough to give me your name, as likely to inform me how to obtain a collection of such vesicant insects as are found in the United States. A gentleman in France who is writing a work on vesicant insects is desirous of obtaining, by purchase or otherwise, a collection. Any information you could give me I should be grateful for.—B. Phillips, New York, N. Y.

You can obtain many of our North American Blistering-beetles, correctly named and at very reasonable prices, through Mr. E. P. Austin, 46 East Newton St., Boston, Mass., who, upon application, will furnish you a list of such species as he has on hand.

Larva boring along the axis of Apple-twigs.—*T. V. Munson, Denison, Tex.*—The larvæ which you send and which are boring cylindrical burrows along the axis of the twig, are not those of the Apple-twig borer (*Amphicerus bicaudatus*) but of some Long-horned beetle, belonging evidently to the genus *Oberea*. We shall be glad to receive further specimens, and also any further facts from you as to whether it is abundant or occurs in diseased or healthy twigs.

Aquatic Larvæ.—Will you be kind enough to give me specific names for the two larvæ sent herewith; one of a Dragon-fly, the other of a May-fly. The latter is extremely common in the stomachs of a great variety of fishes.—S. A. F., Normal, Ill.

The former is the young larva of *Anax junius* Drury, one of our largest Dragon-flies; the latter, the larva of *Palingenia bilineata* Say, and, judging from its size, that of a female specimen. As you are doubtless aware, Ephemerid larvæ largely form the food of all sorts of aquatic animals.

First Appearance of Cotton Worm in Prairie Belt.—Herein I send you a slip from the Montgomery *Advertiser*, in which it is shown that Cotton Worms have been discovered in large numbers on several farms in Butler County. If you will examine the maps, you will see how nearly this first appearance of the worms corresponds in location with their first appearance last season. Why do they always appear first on or near the Prairie belt, and not on the sandy lands further south?—James F. Bailey, Marion, Perry Co., Ala., May 23, 1880.

I send you a slip from the Montgomery *Advertiser* of to-day, showing the Cotton Worms have made their appearance on the Moss Place, which is near the middle of Lowndes County. My son, who knows the worms well, informs me he found a worm nearly grown, last Monday, on the farm of Mr. Geo. P. White, adjoining the field of Howell, where the worms made their first appearance in this vicinity last season.—*Id.*, May 29, 188c.

We can best answer your questions by referring you to chapter six, p. 18, of Bulletin 3, U. S. E. C. We think there is little question that on the prairie belt the cotton is more luxuriant and advanced than in the sandy lands farther south.

Gyrinus Larva: Terrestrial Insects in Stomach of Shad.—I have sent you to-day two packages, one containing a larva of *Gyrinus*, an aquatic Coleopter, the other containing terrestrial insects. The latter are from a mass comprising many species of minute insects (*Chalcids*, *Jassus*, *Tiphleps insidiosus*, and several *Diptera*), found in the stomach of a small Ohio shad. I took the stomach out myself and examined it immediately, or one might imagine that a mistake had been made. There was not a trace of any aquatic creature in the stomach.—S. A. F.

The Coleopterous larva is evidently that of some *Gyrinid* and probably of the genus *Gyrinus*. All that we know about the larvæ of this genus is based pretty much upon what Modeer wrote about a century ago, and according to that author these larvæ are distinguished from all other aquatic *Coleoptera* by having a series of lateral, ciliated, abdominal filaments, which yet show on the partially macerated abdomen of your specimen. Your larva differs from the description in the mandibles being toothed, but it is not at all uncommon with Coleoptera for the young larva to have toothed mandibles, the teeth being subsequently lost as full growth is acquired. In the smaller vials, No. 1 is a *Typhlocyba* which may be a form of *vitis*. The species in this genus are extremely variable, and it is doubtful whether *vitis* Harris is anything more than *basilaris* Say. No. 2 is a little *Muscid*, the wings of which are so crumpled that the genus cannot be determined. It looks very much like an undescribed species which we have reared from a larva mining the leaves of *Verbena*. No. 3 is an interesting *Eurytomid*, a sub-family of the *Chalcididæ*, and approaches *Isosoma*. Without the other sex, generic determination is hardly to be ventured on, and as to the species, these minute creatures have been so little studied in this country that the one in question is in all probability new.

DESCRIPTIVE DEPARTMENT.

FURTHER REMARKS ON THE DIFFERENCES BETWEEN PRONUBA AND PRODOXUS.

BY C. V. RILEY.

In our original reference to the Bogus Yucca moth, as quoted on p. 143, we stated that the female differed from *Pronuba yuccasella* not only in lacking the maxillary tentacles, but in the ovipositors being "of different shape and faintly notched superiorly," the statement having been made upon examination with an ordinary lens of the specimens borrowed from Dr. Hagen. As none of the specimens which we had subsequently obtained had the ovipositor extruded, we could not very well verify, under the microscope, our previous description of the ovipositor, and were led to the opinion that the notched character might be due to a varying degree of contraction in the dry specimens, and further that the ovipositor of *Prodoxus* was probably not exsertile.

Having recently found in Washington, D. C., the *Prodoxus* more abundant even than *Pronuba*, we have been able to make a more careful study of the ovipositor and we find that, as in the other structural characters, the differences between the ovipositors of the two are striking and important.

In *Pronuba*, when the ovipositor is entirely withdrawn, the tip of the abdomen presents a truncate appearance, the terminal joint being bluntly rounded at tip, with a slight projection both above and below, and a corrugated ridge dorsally a little in advance of the tip. This terminal joint is very much compressed from the sides, with a few stiff hairs around the terminal borders. The ovipositor issues from the middle of the truncate end, is very fine, tubular, the basal joint beautifully imbricato-granulate, the terminal joint perfectly smooth, long and peculiarly constructed at tip, the extreme tip being notched or serrate, and a dorsal membrane, also finely and sharply serrate, running anteriorly from it—the whole recalling in form the caudal and second dorsal fins of the Lamprey (*Petromyzon*). Ventrally along the terminal joint is seen a membranous duct, which broadens just in front of the tip, and has an outlet from which a soft and extensile oviduct can be extruded. The whole structure is, in fact, admirably adapted to cleaving through the fruit of the Yucca and then running into the ovarian cavity.

The tip of the abdomen in *Prodoxus* is not truncate as in *Pronuba*, but pointed and slightly beveled off superiorly. The terminal joint is not compressed but quite considerably swollen, the ovipositor issues from the beveled dorsal portion of it, is dark brown, laterally flattened, between three and four times as broad as in *Pronuba*, shorter; the basal joint with a closer, finer ribbed sculpture, the terminal joint with the end obliquely cut off below and having a series of minute teeth, the ventral one being more conspicuously produced. It has, also, a series of 8 or 9 more prominent, broad teeth along the dorsal edge, while two distinct grooves run along the whole length and several smaller ones are noticeable near the tip. The ventral membranous duct is less conspicuous and has its outlet just forward of the ventral notch at tip.

It requires but little practice to at once distinguish the females by an examination of the tip of the abdomen with an ordinary lens, even if the ovipositor is not extruded; the heavier, more swollen, dark brown and more pointed terminal joint of *Prodoxus* being quite unlike the compressed, ordinarily honey-yellow, more attenuate but truncate terminal joint of *Pronuba*.

THE

American Entomologist.

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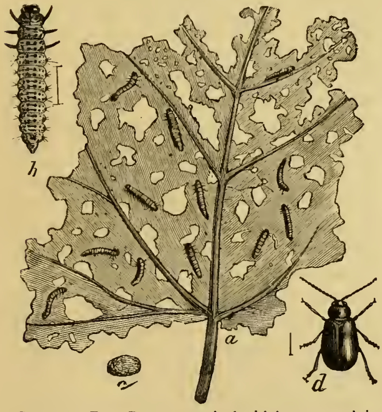
THE GRAPEVINE FLEA-BEETLE (Graptodera chalybea Illig.).

Of the numerous insect enemies with which our grape-growers have to deal, the object of this sketch occupies an important place. The numerous complaints we have received this year of its ravages show that it has been more than usually abundant.

[Fig. 86.]



GRAPEVINE FLEA-BEETLE:—*a*, leaf, with larvæ natural size; *b*, larva, enlarged; *c*, cocoon; *d*, beetle, the swollen hind thighs not shown (after Riley).

The beetles which have hibernated begin their destructive work in the spring as soon as the buds commence to swell, and it is at this early period that the greatest damage is done by the beetles boring into and feeding on said buds. Later in the season the beetles feed upon the leaves, and upon these, in the month of May, the female lays her small orange-colored eggs in clusters. These soon hatch, and the young dark-colored larvæ soon riddle the leaf, as shown in our figure (86), or when very numerous completely devour it, leaving only the largest ribs. In about a month the full-grown larvæ (Fig. 86, *b*) descend into the ground, where each forms a small earthen cell, and changes to a dull yellowish pupa of the shape normally assumed in this family. The perfect beetle issues about three weeks later, from the middle of June to the middle of July, and again begins to eat the leaves, but the damage done to them is trifling compared with that done in early spring. So far as we have observed there is but one annual generation, but it is probable that in the more Southern States there will be two. As soon as cold weather approaches the beetles retire under fallen leaves in the ground, at the base of trees, under loose bark, in houses, in short, in any place which offers shelter from the cold.

In considering the best means of preventing the injuries of this insect, it must be borne in mind, that, according to our observations, the female beetle deposits her eggs by preference on the leaves of the wild grape vines, as the larvæ are rarely met with in cultivated vineyards. It is against the perfect beetle, therefore, that we must direct our efforts at destruction, and while it is undoubtedly desirable to keep the vineyard clear of rubbish in winter time, by burning wherever fire can be used safely, this means of destruction loses much of its importance by the fact that the beetles

hibernate in the woods and in any number of other places where they cannot be destroyed by fire. Dry lime and hellebore, which may be used to advantage against the larvæ, have proved useless against the beetle, while lye and soapsuds cannot be used strong enough to kill it without injurious effects upon the plant. Tin pans or pails with some liquid at the bottom have been used to advantage for collecting the early beetles, which could be knocked into them, and we have repeatedly advised for this and other insects like the Grapevine *Fidia*, which fall to the ground upon disturbance, the use of sheets along the trellis to catch them. Unless repeatedly shaken from such sheets into vessels containing liquid, the beetles will of course soon escape.

The wonderful efficacy of kerosene in destroying insect life has long been known. It was used three years ago with excellent effect in shallow tin pans, or on stretched sheets of cloth, for the destructive locust of the West, and we strongly recommended its use in a similar manner for the destruction of the Cotton Worm, when brushed off from the plants.*

Mr. L. O. Howard, Assistant Etomologist to the Department of Agriculture, last spring employed it successfully on sheets against the Grapevine Flea-Beetle, finding it so satisfactory that he did not hesitate to recommend it in the following terms:

"Take two pieces of common cotton sheeting, each being two yards long and half as wide; fasten sticks across the ends of each piece to keep the cloth open, and then drench with kerosene. Give the sheets thus prepared to two persons, each having hold of the rods at opposite ends of the sheets. Then let these persons pass one sheet on either side of the vine, being careful to unite the cloth around the base of the vine; then let a third person give the stake to which the vine is attached a sharp blow with a heavy stick. Such a blow will in nearly every case jar the beetles into the sheets, where the kerosene kills them almost instantly.

"This process, after a little experience, can be performed almost as rapidly as the persons employed can walk from one vine to another. The expense necessary is very trifling, and boys can do the work quite as well as men. Warm bright afternoons are the proper times for this work to be done, and it should be performed faithfully every sunny day until the vines are out of danger."—N. Y. W. *Times*, May 5, 1880.

* Bull. No. 3, U. S. E. C., p. 54.

Until something is discovered, which, blown or syringed on the buds, will keep off the beetles, this method of Mr. Howard's of dealing with the insect, will remain the best yet known.

FURTHER NOTES AND OBSERVATIONS ON THE ARMY WORM.*

The appearance of this insect in the Atlantic States this year has been marked by several peculiar conditions, and further study of its habits has revealed some new points which enable us to recast the theories which have been proposed in explanation of the phenomena connected with it.

NUMBER OF ANNUAL GENERATIONS.

From the time Fitch wrote so fully on the species in 1861, until the record of our observations in 1875 and 1876, it was the prevailing belief among entomologists that there was but one annual brood of the species, especially in the Northern States, no absolute evidence of a second brood having been obtained. Our experiments that year proved conclusively that there were always two and sometimes three generations in the latitude of St. Louis. The facts that we also recorded as to the remarkably rapid development of the worm, *i. e.* that it can reach full growth within a fortnight after hatching, lent favor to the idea, in our mind, that there might be even more generations. Subsequent experience, and especially that of the present year, has convinced us that there is usually one other generation there, and it is but natural to suppose that there are still more in more southern latitudes. The moths are to be found laying their eggs as soon as vegetation starts in the Spring, and there is a succession of broods from that time till winter sets in; the number differing according to latitude and the length of the growing season. Thus, Prof. Comstock reports it as having been received at the Department of Agriculture, in the larva state, during every month of the past winter, from the Southern States where, during the mild weather, it

* Adapted from an article by C. V. Riley in the *Scientific American*.

was active and injurious to oats and other grain.

There is no doubt that the prevailing theory of its single-broodedness was a result merely of the fact that it is observed in excessive numbers only once during the year, and usually when wheat is just about ripening. But, as we showed in our Missouri Reports (8th and 9th), the worm is always to be found both earlier and later in the season, but attracts no attention because living in its normal Cut-worm condition.

HOW THE INSECT HIBERNATES.

In our prior discussion of this subject we have been led to conclude that the insect might hibernate in any one of the four stages of egg, larva, chrysalis or moth; the evidence then at hand pointing to the chrysalis state as the more normal mode of hibernation in the northern regions, and the moth or imago state in the southern regions. With present light, and especially with the experience of this year, we are led to revise our opinions materially and to believe that, as in the case of so many of our ordinary Cut-worms, the by far more common mode of hibernating is in the larval state. That the insect does hibernate in the larval state is now an established fact, based not only upon the experience just cited from Prof. Comstock, but upon the finding of a partly-grown larva in the stomach of a Blue-bird as early as March 9th, at Normal, Ill., or before vegetation could have fairly started (see Answers to Correspondents in this number). The belief is further confirmed by the lateness of the season in which we have found the worms, and by the finding of the chrysalis and breeding of the moth by Mr. Meske at Albany, N. Y., about the middle of May.* We have absolute evidence, therefore, of the hibernation as larva and as moth; but none of hibernation either in the egg or chrysalis state, though presumptive evidence of the latter.

We are slow in getting at the simple truths in respect to many of our most common insects, because the original observers are so few compared to those who write fluently and copiously at second hand and can of course never add to our knowledge of the facts. The fact of larval hibernation established, gives us at once a better explanation than we have hitherto had of many experiences with the insect. We can, for instance, at once see why the worm will be less disastrous in fields or meadows that have been burned over, and also at once account for the frequent freshness of the moths that are captured in early Spring—a fact attested by many and especially insisted on by Prof. Thomas from his experience the present Spring, as narrated to us.

THE DESTRUCTIVE GENERATION PROBABLY NOT THE FIRST OF THE SEASON.

The hibernation of the larva being admitted, it follows in our mind that the injurious brood will be that succeeding the hibernating one, *i. e.* the resultant from the moths which the hibernating larvæ produce. Passing the winter, in different sizes, under the shelter of matted leaves in unpastured meadows and in grain fields sown in the autumn, these worms will go through their transformations and produce moths soon after vegetation starts. The moths will show little tendency to leave the fields where they were bred, but will lay their eggs in such fields and, under favorable conditions, their issue may, as during the present year, become so abundant as to be obliged to travel therefrom when approaching full growth.

(To be continued.)

SPRINKLERS AND ATOMIZERS.

Inquiries are now repeatedly coming to us respecting the best and cheapest machines and contrivances for sprinkling the various arsenical poisons used in liquid form, and this is the season of the year when the cotton planter more particularly may have to call in requisition such means as may be at his command for protecting his crop from the ravages of the Worm. To meet the inquiries that are so generally being made we have concluded to give

* Cited in 8th Missouri Report, p. 44.

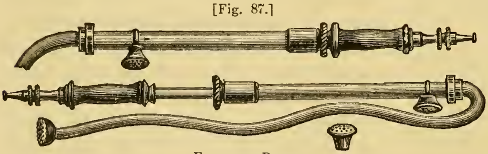
such extracts from our Bulletin on the Cotton Worm as bear upon them. The machines here described will show very clearly the more important principles that should be followed, but improvements and modifications will suggest themselves to any planter who has some degree of mechanical skill. We have already (pp. 41–45) given a full account of the best mode of using London Purple and Pyrethrum powder, and by way of prelude to the presentation of these spraying and sprinkling machines we quote what we said regarding Paris Green :

"PARIS GREEN.—The nature and effects of this poison are now too well and generally known among planters to need consideration. Planters have too often found in its use a path leading from threatened ruin and bankruptcy to be much influenced by theoretical arguments against it. A study of its effects, based upon experience and experiment, whether upon the plant or upon the soil, shows that no harm results from its judicious use.* My expectations in first suggesting its use as a Cotton-Worm destroyer at the Saint Louis meeting of the National Agricultural Congress in 1872, and more confidently recommending it before the same body at Indianapolis in 1873, have been fully realized by the experience of the past seven years. Complaints of its inefficacy are readily traceable either to faulty application or the use of an adulterated article. Its principal disadvantages are its great cost, often increased by the exorbitant profits demanded by merchants, and the consequent temptation to adulterate or imitate the genuine article.† Another disadvantage is the difficulty of keeping it suspended in water, but this is easily overcome either by the employment of an additional hand to keep the water stirred up, or by adding to the various pumps with which the poison is distributed a simple self-acting lever inside of the barrel or other vessel containing it. This, together with the motion of the pump, is sufficient to prevent settlement. Its advantage over the other arsenical poisons, besides its undoubted efficacy, is that it is least liable to scald the leaves and to cause the young bolls to shed.

"If used in liquid suspension, a simple mixing with water is sufficient in dry weather. If pure, one-half pound to 40 gallons will answer. One pound to that quantity of water is more often used, and considered most satisfactory. This is sufficient for one acre of cotton, and the cost per acre of a single application, including labor, varies according to a number of circumstances, but ranges from 25 cts. to 60 cts.* It pays to add two or three pounds of flour or starch to the mixture, not only because of the greater adhesiveness which they give to the poison (a very desirable object, especially in wet weather), but because, by their color, they help to indicate the quantity that has been distributed. In using flour it will be found advisable to mix it first in a bucketful of water and allow it to remain until it sours, the object being to prevent it from forming lumps.

"When applied in powder the green must be mixed with other ingredients in order to render it sufficiently economical and avoid injury to the plants. These ingredients should be cheap and, as far as possible, adhesive. Of the various mixtures that are used to-day and that have come to my knowledge all may be considered good. The proportion of the green to the diluents should be as 1 to 25, though the mixture is often used stronger, or as 1 to 18. Flour, or plaster, or cotton-seed meal are used with equal success, or a combination of them, the proportion being immaterial. Finely-sifted wood ashes may also be used as a diluent, one of the most popular mixtures consisting of one pound of Paris green, 6 lbs of wood ashes, and about 12 lbs of flour. In all cases it is advisable to add a small proportion, say from one to two pounds to the above formula, of some finely-powdered material of still greater adhesive quality, as dextrine, or gum arabic, or slippery elm bark, or rosin. The cost per acre of one application of the dry mixture varies from 50 cents to $1.75, according to the first cost of materials and different modes of application, or, again, to the size of the plants at the time of the application."

[Fig. 87.]



FOUNTAIN PUMP.

* * * * * *

"Before describing these machines, it may be mentioned that the FOUNTAIN PUMP, manufactured by Mr Josiah A. Whitman, of Providence, R. I., has been extensively used in the South for applying liquid poison. These fountain pumps (Fig. 87) are too well known to need any further description. They are sold in the South for about $10 apiece, including the rubber hose. The most common mode of using them is the following: A barrel containing the liquid is put on a cart or wagon and drawn over the field. One hand is employed, if necessary, to keep the poison stirred up, while three others, each with one of these pumps, apply the liquid from the rear of the wagon, one taking charge of the three inner rows, the others each about three more rows on either side. In the use of this and of all other pumps it is advisable to add a strainer to the lower end of the hose in order to prevent impurities from entering the valve. In an emergency, where no machines are at command, these fountain pumps do excellent service, and many prefer them to other means of applying the poison. They are, however, wasteful of material, and the poison is more apt to get on to the bodies of those employed in their use than in most of the other modes of sprinkling.

"Most of the machines used for throwing liq-

* A discussion of this subject will be found in a work by the writer entitled "Potato Pests," pp. 69-75.

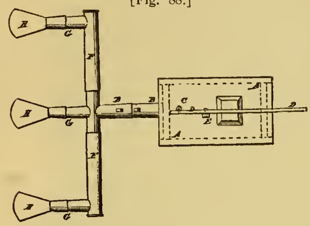
† An easy way of testing the purity of Paris green is to put about 100 grains in an ordinary wine glass and add thereto an ounce of liquid ammonia. In proportion as there is little or no sediment the green may be considered pure.

* The present year, Paris green averaged about 17 cents per pound in Selma, Ala., and 40 cents in Columbus, Tex.

uid on a large scale, whether patented or not, are modifications of one and the same idea and principle, viz., a barrel or other vessel to contain the liquid, a vehicle to carry it, a force-pump firmly secured to the top of the barrel, and a distributing nozzle, or several of them, connected with the discharge-pipe. The differences they exhibit are found principally in the nature of the distributors, the most successful ones being those which least clog, since it is almost impossible to get such pure water that there will not be some clogging material, even where strainers are used.

"THE GOODIN SPRINKLER.—This machine, invented by Mr. James L. Goodin, of Montgomery, Tex. (patent No. 198,014, December 11, 1877), is represented by the accompanying cuts. Fig. 88 is a top view, and Fig. 89 a side view of the same. The letter A represents a tank or any other vessel to receive the poisoned liquid.

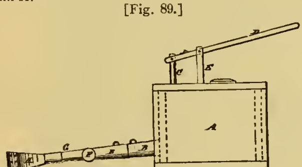
[Fig. 88.]



THE GOODIN SPRINKLER: top view.

" In the lower part of the forward end of the tank A is secured a discharge-pipe, B, the inner end of which is provided with a valve or ordinary syrup-faucet. The stem C of the valve or faucet passes up through a hole in the top of the tank A, and its upper end is pivoted to the end of a lever, D, which is pivoted to a short standard, E, attached to the top of the tank A.

[Fig. 89.]



THE GOODIN SPRINKLER: side view.

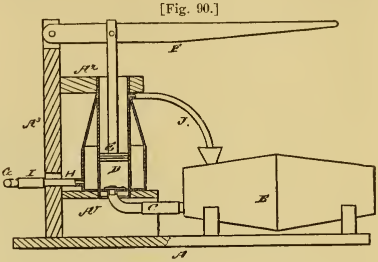
"To the forward end of the pipe B is attached a cross-pipe, F, from the forward side of the center and ends of which project short pipes, G, having heads, H, attached to their forward ends. The heads H are perforated with numerous small holes. The pipes B F are jointed as shown in the drawing, so that they may be lengthened or shortened as circumstances may require.

"THE YEAGER SPRINKLER.—This is a sprinkler invented by Mr. George Yeager, of Flatonia, Tex. (patent No. 204,410, May 28, 1878). Fig. 90 is a part sectional side view, and Fig. 91 a plan view thereof.

" It consists of a platform, A, upon which is laid a barrel, B, containing the poisonous liquid. A rubber hose, C, connects this barrel with the bottom of a pump-cylinder, D. This cylinder is supported on a step, A^1, and its upper end held in a brace, A^2, attached to a standard, A^3, which rises from the platform A. E is the pump-plunger, connected to a lever, F, which is pivoted in the upper end of the standard A^3. The liquid poison is forced out through the sprinklers G G G, which are three in number, and throw the water in a fine mist over three rows of cotton. A rubber hose, I, is attached to each of the spouts H of the pump to form connection with the sprinklers G, for the purpose of lengthening or shortening the spouts, especially the two on opposite sides of the pump, and of detaching and cleaning the sprinklers. The upper end of the pump-cylinder is left open and a spout or tube, J, is connected thereto to conduct the liquid, which would otherwise be wasted, back into the barrel.

"The connection of this waste-pipe with this machine is the only point which is claimed as new by the inventor. The sprinklers or nozzles are

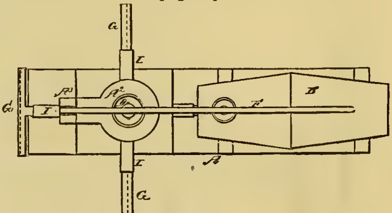
[Fig. 90.]



THE YEAGER SPRINKLER: side view.

not further described, but it is to be understood that the spray is produced in the same way as described in this class of sprinklers.

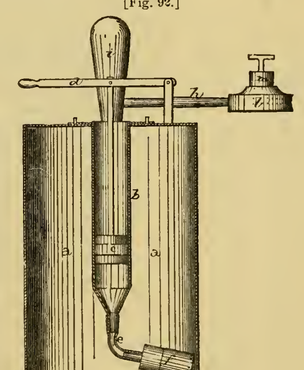
[Fig. 91.]



THE YEAGER SPRINKLER: top view.

"THE RUHMANN SPRINKLER.—Invented by Mr. Julius P. Ruhmann, of Schulenburg, Tex. (patent No. 206,901 August 13, 1878.) This does not differ in any essential respect from the machines just described.

[Fig. 92.]



THE RUHMANN SPRINKLER: longitudinal section.

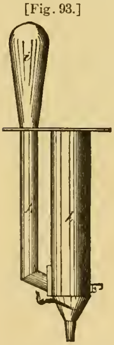
"Fig. 92 is a longitudinal section of the machine; Fig. 93 shows the connection of the pump-cylin-

der with the air-chamber; Fig. 95 represents the strainer; Fig. 94 the nozzle, showing the arrangement for cleaning the same; and Fig. 96 shows a modification of the discharge-pipe.

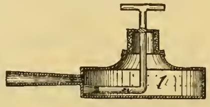
"The letter *a* represents the reservoir for holding the poisonous liquid; *b* is the pump-cylinder in which the piston *c* is worked up and down by means of the lever *d*. The lower end of this cylinder is made funnel-shaped, and to it is fastened the rubber tube *e* which connects it with the strainer *f*. This strainer is made in two parts for the introduction of a straining-cloth, *g*, and for convenience in cleaning. The lower end of the strainer is perforated, and, if desired, any additional straining matter may be placed between the perforated bottom and the cloth, so as to make sure that no substances shall be forced into the sprinkler to clog its action. To the lower end of the cylinder is secured the discharge-pipe *h*, upon the top of which is formed the air-chamber *i*. Upon the outer end of the discharge-pipe is placed the sprinkler *l*, which is round and flat, as shown, and perforated about one-half round. Upon the top of this sprinkler is screwed the cap or cover *m*, secured to which is the brush *n*. The handle of the brush is bent at right angles, as shown, and is secured to the cap in such a manner as to form, as it were, a part thereof, so that as the brush is moved around to clear away any obstructions which may have a tendency to close up the fine perforations in the edge of the sprinkler, the cap turns with it. By means of this screw-cap the brush can be adjusted up and down at will, so that after cleaning off the perforations the brush can be depressed down below the level of the holes, so as to be out of the way.

"Instead of a single nozzle, there may be two or more used by simply changing the construction of the discharge-pipe, as in Fig. 96, which represents one made for the use of three nozzles.

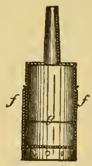
[Fig. 93.]



[Fig. 94.]



[Fig. 95.]



[Fig. 96.]

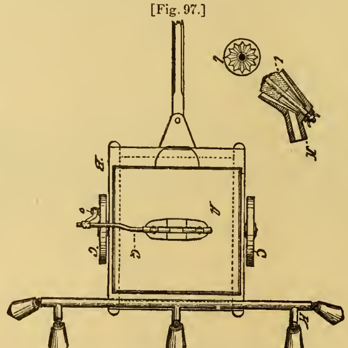
"Several other machines of this class have been patented, but as they are mere repetitions of those already described, and the patents have been obtained on slight changes in the pump and in the arrangement for cleaning the nozzles, it is sufficient to merely mention those that have come to my knowledge. Mr. J. C. Melcher, of Black Jack Springs, Tex., has constructed one, and obtained a patent for the nozzle January 18, 1879. It is of the same shape as that of Mr. Ruhmann, but without the brush, and the cleaning is done by unscrewing the upper cover of the nozzle. Another of very similar nature is the improved sprinkler of Mr. G. Yeager, of Flatonia, Tex., for which a patent was applied for last April.

"If the pump of these machines is made of good material, so as to give and stand a good deal of pressure, and if the nozzle is of sufficient size, or if several smaller nozzles are used, a fine and efficient spray can be thrown over from five to seven rows of cotton when the wind is favorable. In this way about 40 acres can be sprinkled in one day. The price of these machines ranges from $6 to $9, and they do good work, the principal difficulty being found in keeping the nozzles clean.

"The Johnson Spray Machine.—This sprinkler, invented by Judge Jehu W. Johnson, of Columbus, Tex. (patents No. 145,571, December 16, 1873, and No. 145,572, of the same date), is not only the oldest one on record for the application of liquid poison on a large scale, but produces the spray in a novel and peculiar manner.

"The accompanying sketch (Fig. 98) shows this machine in operation. It will be seen therefrom that it consists of a tank placed upon a two-wheeled cart. The pump secured to the top of the tank is a common double-acting force pump, and with the discharge-pipe is connected a transverse pipe. These parts need no furthur description, and nothing new or peculiar is claimed for them. The claim for the second patent mentioned above is based upon the addition of a self-acting pitman, the arrangement of which can be seen in the sketch, and which is more fully illustrated at Fig. 97 The letter A represents the tank, B the platform of the cart, which is provided with the two wheels, C. These are much smaller than ordinary cart-wheels, in order to give the required number of revolutions necessary to the successful operation of the pump. In order to place the cart-bed at such an elevation as to pass over the rows of plants, it is raised by means of vertical bars, as will be seen in the sketch. One of the

[Fig. 97.]



Johnson's Spray Machine:—top view.

wheels C has a crank pin, *c*, attached to it, at a suitable distance from the centre, and to this crank-pin is attached the lower end of a pitman, the upper part of which is attached to the pump-lever G. The discharge-pipe of the pump is provided with a valve to regulate the flow of the liquid. With the transverse pipe before mentioned are connected, by means of screw-joints, branch pipes K, which in the sketch and in the diagram are five in number.

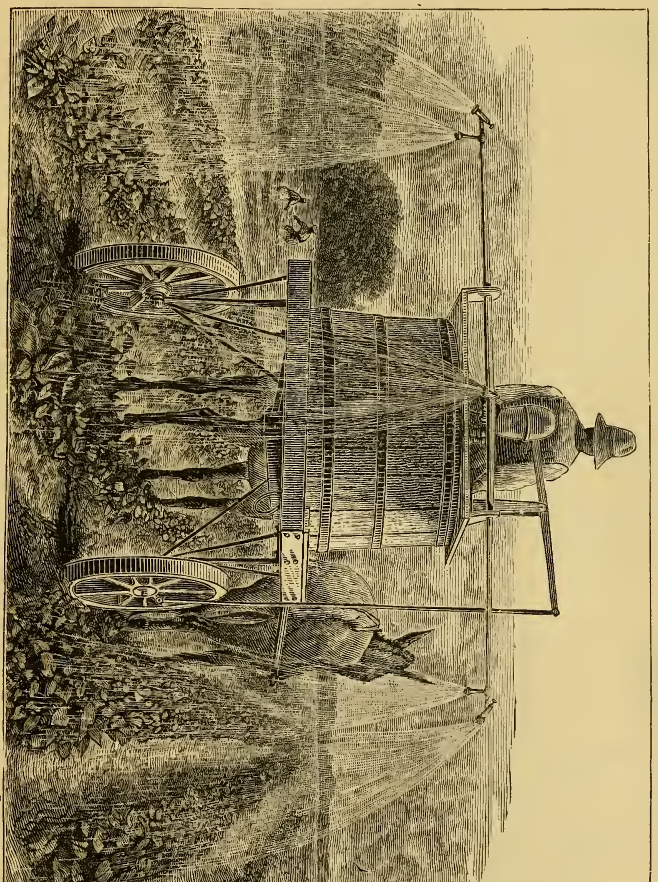
"These branch pipes are made of cast metal, and on their inner surface, at the lower end, grooves, *l*, are formed, either during the process of casting or by planing or cutting them out afterwards. In the lower end of these branch pipes a plug made of rubber or cork is inserted, and a rod extends from the plug to the upper end of the tube *k*, where it engages with a nut by which the plug may be tightened or loosened. It will be seen that the liquid passing through this pipe must escape by way of the grooves and assume the form of spray, and that by tightening or loosening the plug the size of the grooves is increased or diminished.

"This machine makes a remarkably fine spray, but it possesses the same disadvantage as those already mentioned, namely, the ease with which the nozzles clog, notwithstanding the receiving-pipe of the pump is provided with a strainer. This I found to be a serious drawback, requiring frequent stopping of the driver and his dismounting to remove, cleanse, and readjust the plugs. The addition of the self-acting pitman has proved less useful than one would suppose, for Judge Johnson himself writes me that 'experience has demonstrated the fact that it is about as easy and far more economical to work the pump by hand power than to use the pitman rod.' By dispensing with it, the tank may be placed on any cart without special construction. This machine has been considerably used, but its price ($65 without the cart) is very high when compared with that of others here described.

"The following machines produce the spray on a quite different principle and one much better calculated to prevent clogging. They are all recently invented, and by virtue of their decided advantages will, in my judgment, supersede those hitherto mentioned. They do not clog up; they distribute the spray over more rows of cotton, and they are simpler in construction and cheaper."

(To be continued.)

[Fig. 98.]



Johnson's Spray Machine in Operation.

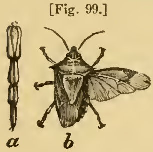
Absence in the field during much of the summer will oblige us to discontinue for the present all book notices and acknowledgments. The present number has been partly edited on the rail, and we ask indulgence for possible shortcomings.

THE COLORADO POTATO-BEETLE.

[*Concluded from p.* 170.]

That the Colorado Potato-beetle has many natural enemies among insects of other orders, is now well known. Among the most formidable of these are the Lady-birds (*Coccinellidæ*) and the Soldier-bugs. The most commonly found of these are the Spined Soldier-bug (*Podisus spinosus* Dallas Fig. 99), and the Many-banded Robber *Harpactor cinctus* Fab., Fig. 100). A two-winged fly (*Lydella doryphoræ* Riley, *Fig*. 102) is also parasitic in the grubs. There are also several species of the Tiger beetles and Ground-beetles, that occasionally attack the grubs, and devour more or less during the season. Another enemy which promises to be a very efficient aid in keeping this pest in check, is the Potato-beetle mite (*Uropoda americana* Riley, Fig. 101). It is a very minute and interesting species of mite belonging to the *Acarina*, and was first discovered in Ohio, and sent to Prof. Riley in 1873.

[Fig. 99.]



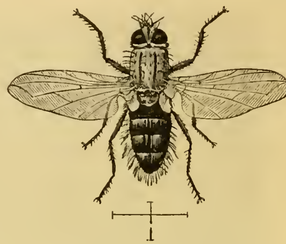
PODISUS SPINOSUS:—*a*, enlarged beak; *b*, bug, with right wings expanded (after Riley).

[Fig. 100.]

HARPACTOR CINCTUS: *a*, bug; *b*, profile view of beak, enlarged (after Riley).

The past season (1879) I found this parasite quite abundant in New Jersey, and it was apparently doing good work in destroying the beetles which it attacks. It does not infest the grubs. But, with all these natural enemies, this Colorado pest appears to thrive, and the potato grower is compelled to lend some additional assistance in order to keep it in check.

[FIG. 102.]

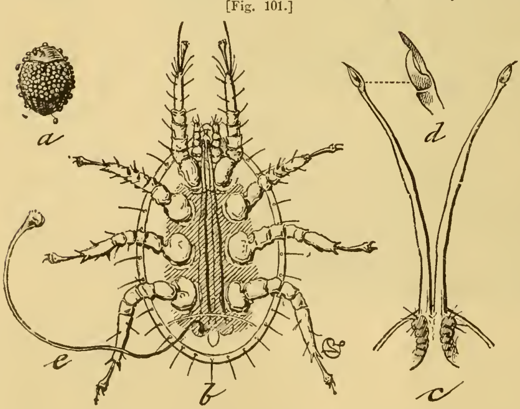


LYDELLA DORYPHORÆ (after Riley).

POULTRY AND POTATO BEETLES.

There has been much discussion over the question as to whether poultry would or would not eat the grubs of the Colorado Potato-beetle, resulting in the discovery that some fowls will eat them, and others not. The taste for such food seems to be an acquired one. Several persons are reported to have taught their hens to eat the grubs by first mixing them with meal and other food, and after the fowls eat the grubs a few times in this way, they will go out among the potatoes and gather the grubs for themselves. I never could discover that my own fowls troubled the grubs, although they were abundant on potatoes growing near the hennery; but a near neighbor had some Light Brahma fowls that

[Fig. 101.]



UROPODA AMERICANA: *a*, Colorado Potato-beetle attacked by it—nat. size; *b*, the mite, ventral view, and showing the penetrating organs lying between the legs; *c*, the organs extended; *d*, the claw; *e*, the excrementitious filament—all greatly enlarged (after Riley).

could be seen at almost all times of the day wandering through the potato fields, seeking the grubs, and they performed their work so thoroughly that not a hill of potatoes was seriously injured in the field, while other potatoes near by would have been, if no poisons had been used, entirely destroyed by the beetles, or their larvæ.

If poultry can be induced to seek the grubs for food, it is well to encourage them by dispensing with the usual application of poisons.—A. S. F.

NOTES ON THE DEVELOPMENT OF A BLACK-FLY (SIMULIUM) COMMON IN THE RAPIDS AROUND ITHACA, N.Y.

BY PROF. W. S. BARNARD, ITHACA, N. Y.

For several years entomologists and others about Ithaca, N. Y., have had their curiosity aroused by the appearance of masses of black worm-like larvæ coating the surfaces of the rocks, etc., in the swiftest waters of this vicinity. They form large black patches, seen beneath the water only at the points where it rushes with the greatest velocity in our falls and rapids. How they can withstand the immense momentum of the water in these places is truly astonishing. But such is the habitat of their choice. Since they do not thrive in quiet aquaria, the problem of breeding them is a difficult one. From a study of the larvæ, I concluded that they belonged to the genus *Simulium*, which is proved by the adults I have bred, and, although I have not yet been able to determine the species, I have worked out its complete biography, and own specimens of all its stages: egg, larva, pupa and adult.

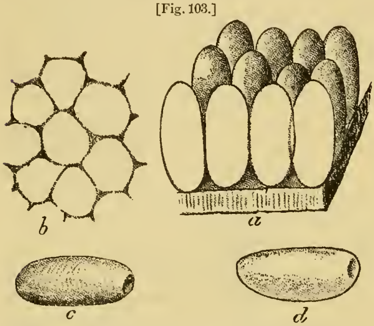
The species of this genus are famous for their fierce, voracious habits. It includes the Black-fly of the North, which has a dagger-like upper-lip and a piercing "proboscis, which draws blood profusely;" the Buffalo-fly of Illinois and the West, which I have observed killing poultry in great numbers, and which is known to torment horses and other animals to death, when very numerous; a Hungarian species, often killing cattle; while in tropical America they are a dreadful scourge, where for several nights I was kept awake by them when trying to sleep in the forests near the rivers, sometimes finding myself and my shirt thickly specked with blood, from their punctures. These minute sand-flies of the Amazon have hard bodies, and the swarm seeks entrance beneath one's garments, from which they cannot be kept out. There they were especially active at night, together with the mosquitoes.

In studying the larvæ at Buttermilk Creek (on July 26th), I saw that in some places they graded down smaller and smaller toward the shore, and then saw in one place, they were thus graded quite up to the water-line, where they were so small as to be hardly visible without a microscope, and then saw the smallest ones on the rocky surface above the water and detected their source. They were issuing from thin brownish masses just a little way above the water on the sunny exposure of the sloping rock. A microscopic examination showed these to be the masses of eggs. I have also found the eggs abundant on the 1st of June. From these the young were passing downward into the water to begin an aquatic life. Here I collected and preserved a large quantity of material, representing the early development from the egg to the full-grown larva. Also I obtained in the rapids, where the larvæ were plentiful, a quantity of pupæ and cocoons, which I supposed (and afterwards proved) to belong to the same species. After watching these insects in several of our streams without further success, and failing to rear them in aquaria, I planned to supply their normal conditions and induce their development where it could be observed. Covering one end of a glass tube with gauze, I inserted several advanced larvæ, and connected the other end with a faucet over a sink so that the water passed through it swiftly. These I observed for many days until they made their silken cocoons and assumed the pupal form, from which the perfect insect finally appeared. But the velocity of the water

was so great as to grind to pieces the mature forms when they came free, so it was with great difficulty I secured three specimens for identification.

I doubt if their eggs have ever been seen before. "The eggs of the Simulia or Sand-fly appear to be at present unknown; there is, however, little doubt that, like those of other gnats, they are deposited on the surface of the water, and in that situation are hatched by the warmth of the sun, combined with the moisture of the water." (*Newman, Hist. of Insects.*)

[Fig. 103.]



EGGS OF SIMULIUM: *a*, portion of mass from side; *b*, do. from top; *c*, *d*, single eggs—enlarged (after Barnard).

The *eggs* are long-ovoid in form, measuring 0.40 x 0.18^{mm}. They are united in a compact layer, often with the sides so pressed together as to make the form somewhat polyhedral, and generally with one end a little flattened or concave. When the fresh egg has imbibed glycerine, a large, somewhat irregular spheroid nucleus, with its distinct spherical nucleolus, appears at one end. The embryonic development proceeds as usual with other flies. The young *larva* is larger at the anal end, which is the last to be withdrawn from the egg-membrane. Its terminal aperture serves as a sucker to attach by, and has its thick margin covered by rows of minute elevated points. Adjacent to this, the youngest larva bears some transparent cylindriform appendages, at least three in number, which are soon to disappear. In front of the anal segment is a ventral prominence. Its convex surface can be retracted to form a concavity or vacuum which helps the larva to cling fast and is essentially a quasi-sucking-disk. The prothorax bears a single proleg, nearly as long as the head, with its distal end covered by a great number of minute denticles or hooklets. This and the anal area are the two points on which the maggot walks, somewhat as loopers or measuring-worms do, only, by doubling itself sidewise, it brings one end by the side of the other, which is then advanced again. Two slender antennæ, each apparently with two segments, and later three, are noticed on the sides of the head. Above the somewhat hairy lower lip is a pair of mouth-appendages, which may represent palpi, each with many short hairs on its end and side. Still higher are the maxillæ and a pair of remarkable mouth-parts, which would naturally represent a pair of mandibles. These are short arms, each bearing on its end an incomplete whorl of extremely long, slender, curved, radiating hooks or bristles, forming rake-like or comb-like appendages, which keep up a grasping, raking motion toward the mouth, seemingly to capture and rake out from the water and into the mouth floating organisms as food. This end of the body is generally elevated somewhat in the water, while the anal end is usually adherent. The larvæ, although light at first, soon become black except on the ventral surface. They grow about 1.50^{cm} long before transforming. A viscid secretion draws out into strong *silk* fibre. It is strange how this substance can harden in water without drying. The larva when loosened from its hold will hang in the swift current, anchored by its thread, or when lifted from the water, several may hang together pendant on these telegraph lines, which seem also to connect the individuals with each other, for they are on a kind of web-work. Finally the full-grown larva spins on the surface of the rock a net-like silken cocoon, which is *boot-shaped*, open above and inclined down-stream *at an angle* with the horizon. In this the pupa form is taken on, its thorax filling the aperture above and bearing some long prongs which project out from it. These queer append-

ages are in two groups, one on either side of the chest (thorax). Five primary trunks arise together, each, except one, dividing immediately to form a pair. They rise in a diverging, somewhat curved manner, and are about one-half as long as the body of the pupa, which differs from the others described in having *nine* horns on each side of the thorax. The chitine walls of these prongs are finely porous. I have detected them *already in the larva* beneath the skin fully formed of epithelial cells, which have not yet deposited the chitine layer. They all arise from the same spot, and I have found them to be branches from *a single internal tube*, a part of which is seen within the molted pupal skin. This stigma-tube from which they arise has a diameter about equal to that of any individual prong near its base. Like the air-tubes of other insects it is composed of chitinous ring-fibres, etc. Thus I have settled beyond doubt the nature of these paradoxical appendages of the *Simulium*. They are respiratory organs of the nature of tracheal gills.

The larval skin is found crammed in by the side of the pupa, and finally the pupa skin is left with it.

The length of the *adult* is a trifle over 4^{mm} (5-32 of an inch); color, dark brown; legs, lighter brown; balancers and basal half of each rear heel (1st tarsal), white; abdomen, blue-gray beneath and toward the sides; antennæ tapering somewhat toward the distal end.

THE USE OF PYRETHRUM.

BY THE EDITOR.

Since we found, in 1878, that Pyrethrum powder was so thorough and effective in killing the Cotton Worm, and particularly since the favorable results obtained by its use in the open cotton field a year ago, as shown in our February number (p. 43), we have had a firm belief that it is to be THE insecticide of the future, and that instead of the thousands of tons of Paris green, and other poisonous and dangerous arsenical compounds that have been sold all over the country, for use against the Colorado Potato-beetle, the Cotton Worm and other great insect pests, we shall soon have this Pyrethrum extensively cultivated and used. The sole objection to it now is the cost; and while those who manufacture it, and put it on the market in small powder packages, would like to monopolize its growth and production, they cannot long do so. It grows almost as easily as Mayweed, or Ox-eye daisy, and we have taken steps to have it tested and introduced in several different sections.

Having, a year ago, commenced a series of experiments which are being continued, we shall report the results, from time to time, and commence with the following notes of a series made in July, 1879, under our direction, by Mr. W. A. Henry, of Ithaca, N. Y.:

EFFECTS OF THE POWDER.

ON FLEA-BEETLES.—*July 9th.*—Tried the powder on young cabbage plants, for the purpose of driving off the Flea-beetles, which were very numerous, having entirely ruined many plants. Dusted the powder over the plants, but do not find it very effective, as the fleas are on the under side of the leaves, and difficult to reach. Moreover, the powder does not adhere well to the glaucous leaves. The insects spring away upon dusting the powder over the leaves, and many evidently escape without carrying any of it with them. Did not observe that the powder affected any of them.

July 21st.—Found the powder still upon the plants. (There has been no rain, and but little dew in the interval.)

Only two Flea-beetles were found, and these were on the under side of the leaf.

ON BLISTER-BEETLES.—*July 19th.*—Found the Striped Blister-beetle defoliating a large Passion Flower vine. Upon applying the powder, the insect was at once affected, and began to make vigorous efforts to remove the irritating substance by rubbing the legs against the body. In less than three minutes, however, it is un-

able to run, and it moves its legs in a drunken sort of way.

July 21st.—One of the beetles, which yielded to the powder two days ago, lies helpless on its back, but keeps up a constant twitching of the last joints of the legs, showing life, but nothing more. It is now more than fifty hours since it ceased to walk, and yet it is alive.

The powder dusted over the vine has completely freed the vine from its enemies.

August 2d.—One week ago rain fell. A few beetles are now found about the vine.

On Cabbage Worms.—*July 19th.*—The imported Cabbage Butterfly (*Pieris rapæ*) is now to be found everywhere in the vicinity of cabbage patches. As they were found about thistle-blossoms, an effort was made to dust powder upon them, as they rested, gathering the honey. This is easily done, but the creature is found to fly away and continue its search for food for some time. Of several so dusted only one is known to have yielded to the powder.

Four were caught and dusted with the powder, and allowed to fly about in the room, where they could free themselves, if possible, from the effects. In three minutes they showed signs of irritation, and in two more their movements were drunken, the power of flight rapidly yielding to the poison, which seems always to affect the limbs first. In ten minutes they were helpless, and after five hours not yet dead.

At the same time the worms of this species were dusted, and in two minutes showed signs of pain, and grew rapidly helpless. A very little of the powder evidently would suffice for these.

In one instance about thirty of the larvæ, mostly full grown, were placed in a tin box, in which was dropped one of the Blister-beetles, that had adhering to its body such of the powder as remained after the beetle had struggled to clean itself. In an hour and a half from the time the box was closed (after placing within it the beetle) it was opened, and all but seven of the worms found dead, or dying, and they had avoided contact with the beetle by crawling to the top of the box.

The power of even a minute quantity of the powder is thus shown to be effective with these pests.

On Squash Bugs.—*July 23d.*—A pumpkin vine was found, upon which were a few full-grown Squash-bugs, and hundreds of smaller ones—enough to entirely kill the vine in a short time. Upon applying the powder, the bugs did not seem to show much irritation, and it was even surmised that they would not yield to its effects. Four hours later, however, it was found that, with hardly a single exception, they were dead, or dying, and lay in great number on the ground, directly under the very leaves upon which they had been feeding.

On Roaches.—*July 24th.*—One of the clerks at the Treasury Department complained of the Cockroaches infesting the desks at which they work. Powder was suggested, and tried upon one desk, and for a week not one has been found about the desk in question, though abundant about the adjoining ones.

EFFECT OF THE FUMES OF BURNING PYRETHRUM.

The Pyrethrum was burned by placing it in a tin dish and applying a match. It took fire easily, and burned like sawdust, giving off considerable smoke.

The smoke was collected in a tight tin case with glass sides.

The first insects placed within were locusts and crickets. These held to the sides of the tin case for some four to five minutes in the dense fumes before they yielded and fell down. They acted much as other insects do when under the influence of Pyrethrum (unburned).

Carnivorous beetles seemed to hold out even longer than the locusts.

Flies in a wire gauze fly-trap were subjected to the smoke, by blowing it through the trap and burning it inside. They were greatly irritated, as shown by buzzing about, and by constantly rubbing the body

with the legs, as if to free it from some irritating substance.

Although in an air with far less smoke in it, they yielded as soon as the locusts.

Nearly two tablespoonfuls of the powder was burned in the kitchen, with the windows closed.

The flies were soon affected in the part of the room where the smoke went, but only one was seen to become helpless.

Several gnats on the window became helpless in a very short time, and a mosquito soon yielded.

These last two instances were very marked.

It would seem that the insects tried were affected in the following order:

Ground-beetles.	Flies.
Locusts.	Mosquitoes.
Crickets.	Gnats.

AMERICAN vs. ITALIAN BEES.

BY PROF. A. J. COOK.*

It would seem from the above that American-bred bees have shorter tongues than those direct from Italy. It seems very probable that "natural selection," the very law which raised the Italians to their position of superiority, also gave to them their longer tongues. Shut up in their mountain home, a mere isolated basin, where competition must have been very excessive, Nature took advantage of every favorable variation and developed those striking excellences peculiar to the Italian. During these ages there was no kindly bee-master possessed of the intelligence sufficient to nurse the weaklings, nor any "Dollar Queen business" to stimulate indiscriminate breeding, and the weak died victims to starvation. And so we are indebted to the stern, inexorable law of nature for the incomparable breeding which wrought out such admirable results in far-famed Liguria. Unquestionably the crowded apiaries of Austria and Germany have heightened the "struggle for life," and had a similar tendency to develop superior excellence in the European black bees. It is more than probable that the German bees of crowded Europe have longer tongues and are generally superior to the same in America, where they have long been favored with broad, floral areas and comparative absence of competition. I should expect that this very law might have developed varieties of the black race which are superior to others of the same race. It is more than possible that "survival of the fittest" explains the origin of the superior varieties which are said to exist in various provinces of Europe. For the same reason we should surely expect superior excellence in the Cyprian bees. Crowded as they have been for long years or ages in their small island home, the principle of "survival of the fittest" must have been working powerfully to weed out the inferior and to preserve and make stronger the superior. And so the great poet has well said: "Sweet are the uses of adversity."

From the above considerations it seems obvious, that would we perpetuate the excellences given us by the skillful breeding of nature, though we may not destroy all the feeble, as nature has done, we must assuredly study and observe so closely, that we shall know of a surety which are our very superior queens, and be even more careful to breed from no other. Whether care or carelessness will be most promoted by our present system, I leave for you to say. But I do wish that we might have at least a few breeders with time, means, caution, skill, and patience, who would work with earnest zeal to not only keep all the excellence we now have, but to augment this excellence, as I am sure it may be augmented.

But if our cheap queen system is to continue, then, surely, we may well stimulate frequent importations from Italy and Cyprus, and thus hope to compensate in part for what will be lost by hasty, careless and indiscriminate breeding.

* From a recent paper on the Tongue of the Honey Bee, in the *American Bee Journal.*

It is stated that last year the Colorado Potato-beetle reduced the starch production of Coos County, N. H., to two-tenths of what it formerly was.

RETARDED DEVELOPMENT IN A BLISTER BEETLE.

The exceptional length of time required in the development of certain individuals of a particular species, is one of the most interesting phenomena in nature.

In the month of October, 1877, we hatched a number of triungulins from the same batch of eggs laid by a female of the Striped Blister-beetle (*Epicauta vittata*), and fed them on the eggs of the Differential Locust (*Caloptenus differentialis*). Several of the resulting beetles issued the following summer; three of them passed a second winter in the coarctate larva state, and issued as beetles the second summer; while one remained unchanged during this second summer of 1879. We. examined it from month to month, always finding it healthy, but began to fear, as the present summer approached, that it must have been injured and was really dead. It was unchanged on the 3d of May of the present year, but on looking at it again on the 15th of June, we were gratified to find that it had left its rigid skin and presented itself in the form of the final or third larva. It had transformed to the true pupa on the 1st of July, and would undoubtedly have given out the beetle two weeks later had we not preferred to preserve it in the pupa state for our cabinet.

In this case the individual, though submitted to exactly the same conditions as the other specimens, which had simultaneously hatched with it—but which went through all their transformations within either one or two years—remained dormant for nearly three years, with their repeated changes of season and temperature. With the exception of the first winter, when it was kept indoors without freezing and when development should have been presumably hastened, the specimen was kept in a tin box buried the proper distance beneath the ground out of doors, so as to be as nearly as possible under natural conditions.

What is the secret of such great differences in time of development of individuals submitted to exactly similar conditions? Who can tell?

OX-EYE DAISY AS AN INSECTICIDE.

Among the different weeds that we have desired to try for possible properties destructive to insect life, is the Ox-eye Daisy (*Leucanthemum vulgare*). The following report of some experiments made at our request by Prof. W. S. Barnard, do not give much hope of it:

"It takes a long time to get the daisies dry enough for grinding to a powder. For several days I have had them in the sun, except at night and when raining, but they are not yet dry. Artificial heat is hardly better, and I have not dared to use much heat for fear of driving off the volatile poisonous element which they are supposed to contain. My flowers are hardly ready yet for grinding.

"But I have improved the time, closely trying the *tea* and alcoholic extracts from the flowers and from the stems. I crushed the parts thoroughly in alcohol in a mortar, and then used a 5-foot glass tube in a large bottle at a gentle heat for a half day with each extract. These extracts should be about as effectual as though made from the powder, so I do not expect anything better from it. I have no evidence that they will prove of any practical value, after having atomized them on to many specimens of larval potato-beetles, aphides, young grasshoppers, *Mamestra picta*, *Pieris rapæ*, and other caterpillars."

Dr. H. Hagen, of Cambridge, Mass., has a short paper entitled "Essai d'un Synopsis des larves de Caloptérygines," in the Annales de la Soc. Ent. de Belgique, pp. lxv—lxvii, giving short diagnoses of the larvæ of the Neuropterous genera *Calopteryx*, *Hetærina*, *Euphæa*, and *Cora* (?). The larvæ, in several instances, have been determined by exclusion. Of special interest are the larvæ of *Euphæa*, as they are provided with lateral abdominal branchiæ, a character recurring in the genus *Sialis*, but unique in the family *Odonata*.

Prof. C. L. Kirschbaum, of Wiesbaden, the distinguished naturalist, and well-known to the entomological world by his papers on Hemiptera, died on March 2d, at the age of 69 years.

DIRECTIONS FOR RAISING PYRETHRUM.

We have lately been obtaining and distributing, on behalf of the U. S. Entomological Commission, the seed of this valuable plant for trial in the Southern States. The following directions for sowing and cultivating have been furnished us by the California growers. That quite so much care is necessary, or that any more is required than for the cultivation of other Compositæ is doubtful, since it has been grown with the greatest ease in past years at Washington, as we are informed by that experienced horticulturist Mr. Wm. Saunders, and also around Ithaca, N. Y., as we learn from Prof. Barnard.

Prepare a small bed of fine, loose, sandy, loamy soil, slightly mixed with fine manure. Mix the seed with dry sand and sow carefully on top of the bed. Then with a common rake disturb the surface of the ground half an inch in depth. Sprinkle the bed every evening, until sprouted; too much water will cause injury. After it is well sprouted, watering twice a week is sufficient. When about a month old, weed carefully. They should be transplanted to loamy soil during the rainy season of winter or spring.

THE COTTON WORM INVESTIGATION.—Prof. C. V. Riley, Chief of the United States Entomological Commission, who has in charge the investigation of the Cotton Worm, arrived in the city yesterday from Atlanta, Georgia, where he met, by appointment, Prof. J. P. Stelle, of Mobile, and Prof. Eugene A. Smith, of the State University at Tuscaloosa. He is accompanied by W. S. Barnard, Prof. of Entomology and Invertebrate Zoology at Cornell University. In an interview, Prof. Riley gave us the following outline of the organization of his corps of assistants in the important work which he is pursuing.

Prof. Stelle will go to Texas, making his headquarters somewhere in the Colorado Bottom, where he will be assisted by Judge W. J. Jones, of Virginia Point, near Galveston.

Prof. Barnard will make his headquarters at Vidalia, Louisiana, so as to fully study those portions of Louisiana and Mississippi which were neglected in 1878 and 1879 on account of yellow fever.

In Mississippi, Prof. R. W. Jones, of the State University, assisted by Dr. E. H. Anderson, of Kirkwood, and Mr. Lawrence Johnson, of Holly Springs, will represent the Commission among the cotton lands of that State.

In Alabama, Judge J. F. Bailey, of Marion, assisted by Mr. James Roane, chemist, of Georgetown, D. C., will make a special series of experiments.

In Georgia, Prof. J. E. Willet, of Mercer College, will make a series of experiments to test the usefulness of fungus germs in the destruction of the worm, and will have the aid and advice of W. G. Farlow, Prof. of Cryptogamic Botany at Harvard.

In Florida, Mr. H. G. Hubbard, a well-known entomologist of Detroit, Michigan, who has been for some time stationed at Crescent City, will make a series of practical observations and experiments, and will hereafter have his headquarters at Tallahassee.

Prof. Smith will be occupied more particularly with the preparation of maps showing the different cotton regions, and indicating a new classification of the cotton belt with reference to the hibernation of the insect.

Mr. E. A. Schwarz, who has been associated with Prof. Riley from the begining of the investigation, and Mr. W. H. Patton, an experienced entomologist of Connecticut, remain at the headquarters of the Commission in Washington during Prof. Riley's absence, and will take the field later in the season at points to which future experience may direct. Prof. Riley leaves to-day for Mississippi, but will be back in this region next week. He will travel from point to point superintending the work, and advising with his assistants. Toward the end of September he expects to go to California to learn everything connected with the cultivation of *Pyrethrum*, a plant which he believes will be one of the future dangerless antidotes to the worm, and the cultivation of which he has already taken steps to introduce in the South.—*Selma* (Ala.) *Times*, July 21, 1880.

STATE ENTOMOLOGIST FOR NEW YORK.—We are glad to be able to announce that

Mr. J. A. Lintner, of the New York State Museum of Natural History, has been appointed to the position of State Entomologist for the State of New York, and that our hope expressed in the May number has thus been realized. The passage of the bill was almost entirely due to his efforts, seconded by the Board of Regents of the University. He was strongly recommended by said Board, by the State Agricultural Society, and by all the leading entomologists of the country. There were several competitors and applicants for the position, but none of them had the experience which Mr. Lintner can bring to bear in editing either Dr. Fitch's unpublished works or a new edition of the published reports, should such work be required. The bill appropriates $2,000, without specifically defining the duties to be performed. We feel confident that Mr. Lintner will make such good use of the opportunity as to insure future appropriations for the good work. The appointment was made by the Governor, and Mr. Lintner entered upon the duties of the office on the first of July.

ECONOMIC INVESTIGATIONS IN THE SOUTH AND WEST.—The U. S. Entomological Commission had a prolonged session immediately after the adjournment of Congress, and perfected plans for carrying to completion the work with which it is charged. As during the previous year, the labor is divided so that Prof. Riley takes charge of that part of the work in which the cotton planter is concerned, while Dr. Packard and Prof. Thomas take charge of the work in the West, relating to the Rocky Mountain Locust. They will be assisted by Prof. Aughey and Mr. Lawrence Bruner, of Nebraska, Dr. John Marten, of Carbondale, Ill., Prof. Allen Whitman, of Minneapolis, Minn., and others. Prof. Thomas left Carbondale on the 10th of July for an extended exploration of those parts of Dakota and British America which embrace some of the most important regions in the permanent breeding grounds of the locust; while Dr. Packard has arranged to leave about the middle of the month for the more western regions of the same, represented in Montana, Wyoming, Utah, and the mountain region of British America. Having organized our own corps of assistants, we expect to start South about the 12th inst.

The annual meeting of the Entomological Club of the American Association for the Advancement of Science will be held at the Museum of the Boston Society of Natural History, corner of Berkeley and Boylston Streets, Boston, commencing at 2 p. m., Tuesday, August 24, 1880.

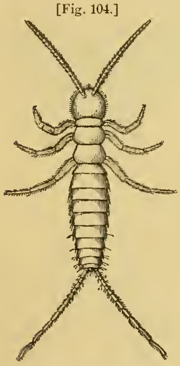
It is proposed to send to every member of the American Association, and to all others who may favor the undersigned with their address for that purpose, a circular announcing the special subjects which will be presented at this meeting of the Club; and, therefore, all entomologists who desire to read communications at that time are requested to notify one of the undersigned before August 1st. This will ensure a fuller discussion of the topics presented, and, it is hoped, a larger attendance.

There will be an informal social gathering of entomologists at the rooms of the Boston Society of Natural History, August 24, 1880, from 10 a. m. to 1 p. m. During the meeting of the American Association, a room will be constantly open for the exclusive use of the entomologists.—SAMUEL H. SCUDDER, *President*, Cambridge, Mass., B. PICKMAN MANN, *Secretary*, Cambridge, Mass.

It appears from Katter's *Index Entomologicus* that Germany takes the lead in the number of devotees to our favorite science. The entomologists and collectors there enumerated are thus tabulated by *Psyche*: Germany, 740; Austria, 213; Switzerland, 97; Holland, 84; Belgium, 93; Italy, 128; Spain, 19; Portugal, 2; Greece, 3; Roumania, 1; Russia, 58; Finland, 8; Sweden, 26; Norway, 2; Denmark, 4; England, 433; Scotland, 15; Ireland, 3; France (whose coleopterists are not included), 197; total 2,126. Of entomological societies, Europe is credited with 17; America, 4, and Australia, 1.

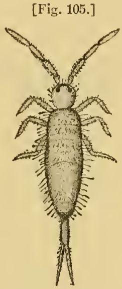
Campodea fragilis Meinert.—This little animal, described in the Annals and Magazine of Nat. H., 1867, p. 377, and "frequent in the neighborhood of Copenhagen, in moist black earth, under stones, etc.," exists here at Ithaca, N. Y., where I have found it (June 8, 1880) in damp sandy earth. Meinert says, "It lives, at least partly, on dead insects, as I have often found in its stomach scales of butterflies and other remains of insects, which it could not have attacked or overcome alive" (*l. c.*). Lubbock's Monograph of the *Collembola and Thysanura* gives us nothing additional, and I doubt if it has been observed in America before. Since this genus is regarded by some as the connecting link between the Myriapoda and the Insecta pro-

[Fig. 104.]



Campodea fragilis (after Barnard).

[Fig. 105.]



Degeeria lanuginosa (after Barnard).

per, and as representing the original stock (see Lubbock, *Origin and Metamorphoses of Insects*), from which all the orders of insects have been derived, its species have an uncommon interest like that of the *Amœba* or of *Amphioxus*. These creatures possess only the most essential marks of insects, and are especially peculiar by having the chewing organs in a mouth-cavity, while they have no metamorphosis and do not develop eyes or wings. Their habitats are obscure, and their habits difficult to study, yet we hope to learn more anon. Closely related to this is *Degeeria lanuginosa*, Nicolet, the "Spring-tail" so common in European gardens ("Dans les jardins, sur la terre; assez commun."—Nicolet), which I find plentiful in our gardens here.—W. S. Barnard, Ithaca, N. Y.

Every Coleopterist appreciates the value of Harold and Gemminger's "Catalogus Coleopterorum hucusque descriptorum," an admirable work, which is as perfect as works of this character well can be. In consequence of the great activity in descriptive coleopterology, the work soon became incomplete, because of the many species described subsequent to its publication. Baron von Harold himself does not contemplate publishing a new edition of this work; nor is it likely that any other coleopterist will be willing to take upon himself the difficult and laborious task of completing and preparing a new edition. But this work might be done by the coöperation of specialists, and we are glad to see that M. E. Candèze, the well-known author of the *Monographie des Elatérides*, is publishing, in the *Comptes-rendus des Séances de la Société entomologique de Belgique* of this year, a "*Liste des Elatérides décrits postérieurement au Catalogue de Munich*," thus bringing the catalogue up to date in at least one family. It is to be hoped that other competent specialists will follow his example.

Parasitic Rove-beetle: Aleochara anthomyiæ, Sprague.—This beetle, described in the *American Entomologist* II, 370, as developing in, and bred from, the pupæ of the Cabbage-fly (*Anthomyia brassicæ*), is now very abundant at Ithaca, N. Y. Since the description of this new species and its astonishing parasitic habits, nothing concerning it has come to my notice. As my beetles are twice as large as those described, I think the original measurement may possibly have been made from specimens shrunk in alcohol. They are often seen running from one young cabbage to another, or entering holes, but more commonly close about the stalk. Half of our young cabbages here, last year and this, have been killed by the maggots, and now on pulling up an infested stalk, these beetles often come out, sometimes

several from about one plant. To test their habits, I put a maggot in a bottle with them. When hungry, a single one alone will attack a full-sized maggot, tearing open its sides and feasting upon it. I have seen five of them like a pack of wolves, cling to and tear a writhing maggot, killing it quickly. They are wonderfully active, and promise to be the best enemy against the fly, which has ruined so many crops here.—W. S. Barnard.

CARNIVOROUS PROPENSITY OF PLANT-FEEDERS.—On the 17th of July we collected near Atlanta, Ga., from one and the same cabbage head, 2 larvæ of *Plusia brassicæ*, 2 of *Pieris rapæ*, and 3 of *Pionea rimosalis*. Upon looking at them on the 20th, having had no opportunity meanwhile to furnish them with food, the *Plusia* larvæ had devoured all the others, and it were doubtless but a question of time as to which of these two would finally succumb to the other, in default of more natural food.—*Selma*, Ala., July 21, 1880.

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Beetles injuring Cabbages and Fuchsias.—The larger specimens in the box I send you with this are the cabbage-eating beetle I mentioned the other day. It comes from near Felton, Del., where it is "destroying early cabbages, eating the leaves and sucking the juice from the stems." Not noticed before this season.

The little fellow—in a paper within the box—(a Chrysomelid?) is from Norfolk, Va., where it swooped down in "a cloud," and in two hours ruined over 600 blooming plants of Fuchsias. Paris green killed the beetles, but spoiled the looks of the plants, and they can not be sold. Appeared to touch no other plants.—G. T., New York, N. Y., June 20, 1880.

The beetle injurious to early cabbages is the Imbricated Snout-beetle (*Epicærus imbricatus* Say, Fig. 106), a snout-beetle belonging, according to the recent classification of the *Rhynchophora*, to the family *Otiorhynchidæ*. It occurs quite frequently in all the more southern States east of the

[Fig. 106.]

EPICÆRUS IMBRICATUS (after Riley).

Rocky Mountains, under sticks, stones, and various plants. It often does considerable injury to fruit trees, and even to gooseberry bushes, by gnawing the trees and fruit, and in some years it is to be found on all sorts of plants. In 1873 it was quite injurious to corn, but we have not before heard of its injuring cabbages.

The little green beetle so injurious to Fuchsias at Norfolk, Va., is, as you suppose, a *Chrysomelid*, sub-family *Halticidæ*, or *Flea-beetles*, and is known as *Graptodera carinata* Germ. It is a very common species, feeding upon a great variety of plants, and we found it very injurious to Fuchsias in 1874, at St. Louis, especially on the grounds of Mr. J. M. Jordan. It also attacks many other greenhouse plants.

The beetles fly in summer, and first appear during the month of June.

The eggs, which are 0.7$^{mm.}$ long, about one-third as wide, orange, opaque, not shining, are laid flat on the side, in irregular masses of 5 to 10, on the underside of the leaf. Generally a little streak of excrement is found along the top of the mass. The larvæ have very much the same appearance as those of the Grapevine Flea-beetle illustrated in this number. We have noticed that when they affect Fuchsias they first prefer small-foliaged or narrow-leaved varieties, like "Elm City." The same species often swarms on Fire-weed (*Erechthites hieracifolia*).

In our experience we found that the use of Paris green did but little good, but Pyrethrum not only numbed them, but kept them off the plants until it was necessary to water them again.

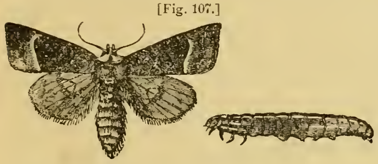
We have reared it from larvæ found feeding on the common Evening Primrose (*Oenothera biennis*). Its natural history is the same as that of the Grapevine Flea-beetle.

Spider and Nest.—*Mrs. J. B. Harrison.*—The spider you send is *Acrosoma* (*Epeira*) *stellata* Hentz., a species not uncommonly occurring in the United States, east of the Rocky Mountains, and easily recognizable by its abdomen being armed at the sides and behind with a number of pointed tubercles. The cocoon is in reality the egg sac, a delicate web for the protection of the numerous eggs within.

Damage to Wheat : Worm boring in the Stalk.—Inclosed I send you a maggot or worm new to me, and which I found in my wheat, and still it may be an old enemy. You will find in the inclosed vial samples of the stalk or joint where the maggot was laid or the mature worm has entered. It is the first joint below the head. One of the worms is out in the vial, another is tied in the stalk. I send also samples of the shrunken berry or blaster. The head turns yellow, as if ripe. I have noticed in a number of fields a great many such heads within a day or two. A very serious damage is being done to wheat, especially the later varieties, and where the winter injured it so as to make it ripen late. I think the Hessian fly is also working in some places badly. I have not discovered much damage in my Fultz wheat, which will be a few days earlier than the Clawson, the inclosed being of this variety.—A. R. Frost, Millport, Chemung Co., N. Y.

The worm so injurious to your wheat by boring in the stalks, is what is popularly known as the Stalk-borer, the larva of a night-flying moth (*Gortyna nitela* Guen., Fig. 107). It bores in the stems

[Fig. 107.]



GORTYNA NITELA : 1, moth ; 2, larva (after Riley).

of potato vines and a number of other plants, sometimes doing considerable damage, and is also known to infest in the same way corn, pie-plants, several garden flowers, and other plants. It has for some time been known to injure wheat, and an excellent account of it was published by Miss Emily A. Smith, in the 7th Illinois Entomological Report by Prof. Cyrus Thomas, p. 112.

Larvæ from Stomach of Blue Bird.—*S. A. F., Normal, Ill.*—The Coleopterous larva you send from the stomach of a Blue Bird is that of *Meracantha contracta* (Beauv). We first raised it in May, 1866. The larva, which is not uncommon in rotten logs in the western States, is easily distinguished from other Tenebrionid larvæ with which we are familiar, by its deep brown color, but particularly by the enlarged anal end obliquely truncate above and deeply excavated. The Lepidopterous larva, marked *a*, and taken in July, is a *Callimorpha*, and very probably the common form *lecontei*. You will find some account of *C. fulvicosta* Clem. in our 3d Mo. Report, p. 132. That marked *b*, and found in February, is evidently of the same genus, but lacking the median dorsal pale line. These larvæ vary considerably, and are much blacker before the last molt than subsequently. They hibernate in different stages of growth, frequently under the bark of trees.

Butterfly Larva Injurious to Cotton Squares.—I send you to-day a specimen of Boll-worm, a perfect stranger in these parts. I have detected some three or four at work this spring on my cotton. They penetrate the square exactly like the common Boll-worm ; but, as you will see, it is entirely different in appearance. If convenient, let me hear from you in regard to the worm.—B. F. Cooke, Marion, Ala.

The slug-like larva which you observed penetrating the squares of cotton plants is that of a small butterfly belonging to the genus *Thecla*. The butterflies of this genus are very handsome, often marked with blue on the upper side of the grayish-black wings, and having a slender, thread-like appendage on the hind wings. The specimen is too much disfigured to warrant specific determination, as the larvæ of several are very much alike. The species is probably *Thecla poeas* Hübn. It is not uncommonly met with in cotton fields, and the larva is known to feed on cotton leaves ; but the fact you communicate, that it also attacks the squares, is quite new to us. This species is, however, not common enough to do any serious damage. The specimen you send proved to be infested with small ichneumon-flies, belonging to the genus *Microgaster*. We should be very much obliged to you for any information regarding insects injuriously affecting the cotton plant, and for any facts you may communicate regarding the destruction of the Cotton Worm.

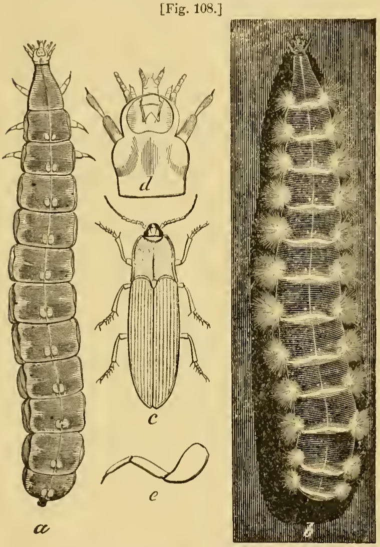
Cut-worms from stomach of Robin.—*S. A. F., Normal, Ill.*—The two vials marked *J* and *I* have come to hand. The larva in the former, taken from the stomach of a Robin at Galena, Ill., March 31, 1880, and that in the latter, also from the stomach of a Robin at Normal, Ill., Feb. 27, 1880, are not Army Worms, though having a very close resemblance thereto. The former belongs to some *Agrotis*, and probably the same as the latter, which is the fourth larval stage of an *Agrotis* and apparently *Agrotis messoria* Harr. There are quite a number of our ordinary Cut-worms that have a general resemblance to the Army Worm, even to the general markings of the head, and it is this part that has to be more particularly studied in determining them. It is by a critical study of the heads of these specimens that we are able to say positively that they are not *Leucania*. *Agrotis cochrani* Riley is synonymous with *A. messoria* Harr., and an account of its habits was published in our 1st Missouri Report, under the name of the Dark-sided Cut-worm.

Large Phosphorescent Larva.—A gentleman showed me to-day a beetle larva which had been found by a friend in the mountains of Maryland. It is three inches long, dark cream color, and the head retractile into first segment. It is brilliantly phosphorescent between the segments on the dorsal side, a bright row of spots on each side corresponding with the stigmata, and on the

ventral surface are constantly four pairs of bright *dots*, and others are occasionally flashing. The owner was so cautious of it that I could not get any structural points.—Saml. F. Clarke, Ph. D., Baltimore, Md., June 22, 1880.

We have on several occasions found this luminous larva in Missouri, usually in cellars, and have in vain endeavored to rear it to the perfect state. The accompanying figure, made some years ago for an article on luminous larvæ, not yet published, will serve to indicate its character, and the beautiful appearance it presents in the dark. We think Baron Osten Sacken right in conjecturing this larva to be that of *Melanactes;* yet, when Packard, in his "Guide," speaks of his figure 426 as that of *Melanactes* without qualification, he conveys a wrong impression, since no one has ever decided the matter positively by breeding.

[Fig. 108.]



LUMINOUS ELATERID LARVA: *a*, dorsal view; *b*, do., in dark; *c*, probable parent—nat. size; *d*, head of larva; *e*, leg of same—enlarged (after Riley).

There is another larva occurring in the more northern States, which has very much the same appearance and the same phosphorescent peculiarities, but which is seldom half as large as that which you send, and which we figure. Both Mr. E. P. Austin and Mr. B. P. Mann, who have studied this northern form, believe that it belongs to *Asaphes*, and probably *A. memnonius*, being led to this conjecture by the absence of *Melanactes* in New England.

Worms Injuring Wheat.—"Osage County.—A little white worm, from an eighth to a quarter of an inch in length, has about destroyed twenty acres of wheat for Squire Dick Campbell. It attacks the stalk at the first joint below the head and cuts it nearly in two. Not a single wheat grain was to be found in twenty or more heads examined by us. The field attacked is located in the bottom. An upland field only a short distance away is, as yet, entirely unharmed, and promises an abundant crop."

I clip the slip above from the *Republican*, of this morning, and as I am not sufficiently informed to determine what the mischief worker may be, I refer the matter to you, and will be pleased to have you tell me.—James Monaghan, St. Louis, Mo.

We take it that the worm referred to above is the American Meromyza, the maggot of a two-winged fly, referred to on p. 181 of our last number.

Ash Root Borer: Supposed Eggs of Odontota.—In compliance with your request, I have collected more specimens of the Ash-boring larva, which will be forwarded to you forthwith.

In plying the ax, several specimens appeared in the pupa state. Also observed that the tree breaks by wind pressure where most bored, usually near the ground, sometimes ten or twenty feet up; that above the fracture many of the depredators perish by drying of the wood; that wood decay begins at the center, and progresses outwardly; that avoiding the outward shell and the inward mush, the larvæ feed where decay is incipient; that, as one of the enclosed blocks plainly shows, where they venture near the surface, they fall a prey to the woodpeckers; that away from browsing live stock, young Ash seedlings are plentiful and healthy; that this insect is most numerous in trees of full, mature growth, and that exposure of the trunk to the sun hastens the increase of the insect.

In a small box within the larger one you will find two Linden leaves. On one is the cocoon of a small, but numerous spider; upon the other a deposit of globular eggs, which may belong to Mrs. *Odontota Rubra*.—Shelby Reed, Scottsville, N. Y.

The roots of Black Ash infested with the Borer finally reached us, and, having found in it specimens of the perfect beetle, we were enabled to determine the species. It is the *Parandra brunnea* (Fabr.), a species which, in the larva state, is frequently found within dead, or decaying wood, of various trees, especially of Oak and Beech. This species is not known to attack healthy timber, and from the specimens you send, and from what you state in your letter, it would appear that the decay of your trees is not primarily caused by the borer, but is due to some other cause.

But there can be no doubt that the death of the trees is accelerated by the working of the *Parandra* larva, and thus the species may be considered as injurious, especially where it occurs in such vast numbers as in the roots of your Ash trees. We found an Ichneumon fly belonging to the genus *Pimpla* parasitic upon it, but too rarely to materially lessen its numbers.

The supposed eggs of *Odontota rubra* are in reality the eggs of some true bug. The eggs of the *Odontota*, whatever they may look like, must

be much smaller, and, judging from the working of the larva, they are probably laid singly on the leaves.

Army Worm Notes and Inquiries: Its Work on Clover.—Our Camden Microscopical Society has been very active in the study of the Army Worm (so called), that has been so very destructive throughout New Jersey. As Prof. Lockwood made a statement to the effect that a clover field was destroyed, I made special effort to ascertain if this was generally the case, but failed to receive one reply (to my many inquiries) that confirmed Lockwood's statement. I have ten or fifteen answers which state that the clover was uninjured, where other grasses were entirely destroyed. As you have had considerable experience in the study of this pest, I took some interest in the matter, and endeavored to find the work you issued, but nowhere could I see a copy, or could any one tell me where to look for it. So I was left in the dark; and if you could spare but a few minutes to give me a line or two in reference to this debated question of clover, it will add to my indebtedness to you for the very kind favors received.—L. T. Derousse, Camden, N. J., July 6, 1880.

As a rule, the Army Worm does not injure clover; and we have frequently known it to pass through a field, eat out all the grass, and leave the clover practically uninjured. On the other hand, where clover and timothy have been sown in rye, and the worms appeared in the field while the clover was yet young, we have known them to absolutely destroy it. We published an account of this insect in the July number, and you will find some other matter on the subject in the present number. Our principal articles on the insect were published in the 8th and 9th Entomological Reports of Missouri.

Ichneumon from Stomach of Blue Bird.—I inclose a Hymenopter eaten in quantity here by Blue Birds in February. This particular one was taken from the stomach of a Blue Bird shot here Feb. 27, 1880. Will you give me the name?—S. A. Forbes, Normal, Ill.

Our esteemed correspondent having omitted his usually careful and guarded method of mailing, the specimen reached us crushed to pieces. The fragments were sufficient to show that it belongs to the genus *Lampronota*, but beyond this we cannot safely venture on determination.

Leaf-miner on White Oak.—If not trespassing too much on your time, may I ask you the name of an insect that is now affecting the leaves of the White Oaks here, and making the trees look as if *Cicada septemdecim* were about. Its larva lives between the upper and lower surfaces of the leaf mines, the cellular tissue and the leaf shrivels and curls, and turns brown, giving the tree a half-dead appearance. They are now going into the chrysalis form, and I have some of them put away. I suppose they will issue shortly, or, at any rate, before the leaves fall. The larva is about ⅛ in. in length.—E. W. Claypole, Antioch College, Yellow Springs, Ohio, July 4, 1880.

The Leaf-miner which you send, so far as we can determine with certainty from the dried specimen, is that of *Lithocolletis*. Mr. V. T. Chambers, who has great familiarity with these little miners, and to whom we referred your specimen, says that, without doubt, it is his *L. cincinnatiella*. It is sometimes very abundant, and injurious, on the White oak, as you describe. The parent moth has the front wings of a deep golden or tawny-yellow color, and with four elbowed white streaks, shaded with black powder-like patches. Do not hesitate to ask questions, especially if accompanied with specimens.

Screw Worm: Its Parentage in Doubt.—In describing the parasites of Aletia, you mention (p. 39, of Bulletin) *Sarcophaga sarraceniæ*, giving figures of fly, and larva, &c. The name being borne by our blow-fly, and conferred by some on the "screw-worm fly," so common here, leads me to ask you for information about this latter. *Musca* (*Calliphora*) *vomitoria; Sarcophaga carnaria; S. georgina; Musca* (*Lucilia*) *cæsar*—all these deposit eggs or larvæ on *dead, putrid* flesh, *manure, excreta*, &c.; but the "screw-worm fly" *only* deposits living larvæ on *blood*, or bloody *living* flesh. I suppose, while in Texas, you met with specimens of the "screw-worms" and the fly, and I desire you to impart the name of the fly to me—I mean the technical name.

I have tried to get sight of the fly, and have asked several old Texans to describe it, but they are indefinite, and contradict each other; so I am at a loss. Several cases have occurred in my knowledge where persons were blown by the "screw-worm fly," and one proved fatal—the larva being in the nose and frontal sinus. They frequently kill calves, sheep, hogs, and other animals.

I have been called on by professional men living at the North, to give a description of this fly, and report its ravages on animals and men. If you can describe it, or refer me to some book, or furnish me any Departmental report on it, you will greatly oblige me.—A. R. Kilpatrick, Navasota, Texas, June 14th, 1880.

We really wish we could give you the information asked for regarding the parentage of the Screw Worm. In truth, however, we have been endeavoring in vain for some years to get specimens of the fly which was absolutely known, without doubt, to be the parent of that worm; or to get the worms themselves, when mature, or just about ready to contract to pupa, so that we could breed the fly from them. So far our efforts have been unavailing. We have what has been sent to us for the fly, and, as stated on p. 21, it is *Lucilia macellaria* Fabr. If you can help us to mature worms, or pupæ, you will place us under great obligations. If, when fully grown, they are taken from wounds and placed in moist earth, in a tight tin box, they can be safely transmitted to us, and we engage then to answer your questions.

Silk Culture: How to Dispose of Cocoons.—I and very many Germans came, a few years ago, from South Russia to Kansas, to make this beautiful land our home. We brought the seed

of the White Mulberry tree and some silk-worm eggs. The worms produce a large, sound, and deep yellowish cocoon.

The first years in America we only raised a small number of worms, but finally raised more, until we found that there was no market for the cocoons.

Several months ago, I wrote to a Silk Manufacturing Co., in Paterson, N. J., and, after a few weeks, received a letter from the Silk Association of America, New York, written by Wm. C. Wyckoff, Secy., whose reply was: "That there is no market for sound cocoons in this country, as there is no filature." (I had told them that we had prepared the cocoons as it was the custom in Europe, viz.: that we had choked them.) He informed me that the pierced cocoons would be bought by Cheney Brothers, of South Manchester, Conn. But his advice to me was, to address a letter to you, and to ask for information concerning the possibilities of silk culture in this country.

What is your opinion about the filature? We had filatures in the old country, and we always sold the silk made up in threads.—C. F. Durksen, Marion Co., Kansas.

We cannot do better than to send you a marked copy of our Manual on Silk Culture in the United States, wherein you will find some suggestions in the line of your inquiries. We agree with Mr. Wyckoff that the sale of the cocoons in this country is, at the present time, but of little profit; but we have no doubt that if our farmers persevere in their efforts to produce cocoons, some capitalist will establish a filature. Meanwhile, we advise all those who have raised cocoons the present season, to communicate with Mr. E. Fasnach, of Raleigh, N. C., who has, we believe, made arrangements whereby, as agent of a French house at Marseilles, he will purchase such cocoons at a price which, though not as remunerative as it should be, will be much in advance of that paid by Cheney Bros. for pierced cocoons.

Best Cotton Worm Destroyer.—I am in receipt of a report made by you in regard to the Cotton Worm, and sent to me through Hon J. H. Acklin. As I am largely interested in the cotton crops of this portion of the country, having made large advances to the planters, I respectfully demand of you to inform me which is the best poison to kill the worms, and what is the best machine used?—J. G. Dauterive, Laureanville, La., June 25, 1880.

We can only state that your inquiries as to the most reliable poison for the destruction of the Cotton Worm, and the best machines and methods for the applications of these poisons, have been discussed in our Bulletin on the Cotton Worm. You will also find the prices of the different machines, as well as the addresses in said bulletin. The poison which we deem best, as there shown, is London Purple, and the cheapest mode of applying depends entirely on circumstances and the conveniences at hand. We hope you will have no difficulty in deciding for yourself on the different machines described. You ought to be able to obtain London Purple from any of the large druggists; if not, you might send direct to the manufacturers.

Twice-stabbed Lady-bird.—I inclose a beetle which a friend tells me he has found in large numbers on the limbs of his cherry trees this year. Will you tell me its name (in the next *Entomologist*), and whether it is injurious?—H. N. Patterson, Oquawka, Ill.

The species is the Twice-stabbed Lady-bird (*Chilocorus bivulnerus* Muls., Fig. 109). The numerous species of the Lady-bird family are among the most beneficial insects, as they feed, in both the larvæ and imago states, on Plant-lice and scale insects so injurious to vegetation. Your specimens should be protected and encouraged as much as possible. Their presence, in large number on limbs of cherry trees, simply indicates that the trees have been badly infested by some species of Plant-lice, probably the common black Cherry Aphis. A short description of the larva of your species is given on p. 132 of this magazine.

[Fig. 109.]

CHILOCORUS BIVULNERUS.

Pseudo-scorpion.—*C. H. S. Davis, M. D., Meriden, Ct.*—The drawing you send fairly represents *Chelifer cancroides* Linn., which belongs to the Family *Chernetidæ*, or Pseudo-scorpions. This species is not infrequently met with in old, rarely used books, in cracks of furniture, etc., while allied species occur under dry bark of trees and under decaying leaves. The Pseudo-scorpions are known to prey upon mites, spring-tails, and other small and soft insects. You will find a figure (not a very good one) of your species in Packard's *Guide to the Study of Insects*, 3d ed., p. 658.

Bluebirds feeding on parasitic and predaceous insects.—I send three more larvæ from stomachs of Bluebirds. I have now examined thoroughly 59 stomachs of this species—10 taken in February, 10 in March, 14 in April, 9 in May, 6 in June, 8 in July, and 2 in September—and find, to my astonishment, that the species is much more destructive of parasitic and predaceous insects than the thrushes. I have made my estimates of the ratios with the greatest care, testing them in every way I could think of, and I am sure they are nearly right. Of the 59 specimens, 10 per cent. of the food was spiders, 8 per cent. *Carabidæ*, and 4 per cent. *Ichneumonidæ*, making a total of these three kinds alone of 22 per cent. —S. A. Forbes, Normal, Ill.

The specimen marked "*c*," taken from a bird shot at Normal, Ill., March 9th, 1880, is the larva of *Leucania unipuncta* Haw., the common Army worm. This is a most interesting fact, and throws much light on the hibernation of this interesting insect. The specimen is in the fourth larval stage, and the earliness of the season precludes the possibility of its having hatched this year, and renders it well nigh certain, that, like so many other Noctuid larvæ, it had hibernated in that

state. The only other explanation permissible is that the bird had flown from some Southern region, where the *Leucania* larva had had time to hatch and develop, on account of the greater earliness of the season. But the freshness of the specimen renders this highly improbable,

That marked "*e*" is the larva of the *Telephorus bilineatus* (Say), which you will find described in our 4th Missouri Report, p. 29. Its habits are there set forth, and it should be classed among the beneficial insects, being one of the few enemies of the Apple worm.

That marked "*d*" is a nearly full grown larva of *Nephelodes violans* Guen. It is our No. 453, and we have been familiar with it for many years, having reared it in 1871, after many previous futile efforts. It is quite common in Northern Illinois and Missouri in early spring, when it may be found on Blue-grass sod, generally concealed under some stone or board during the day, though we have occasionally found it feeding on some grass stalk in the hot sun during the day time. The larva is found full-grown as soon as spring opens, so that it undoubtedly passes the winter, like so many other Cut-worms, in the larva state and of different sizes. This insect is quite common and widespread, for we have found that the larva had been quite common in 1871 around Ithaca, N. Y., on Blue-grass sod and under clover. It was first described by Mr. G. H. French in the *Prairie Farmer* for April 6, 1878. Being one of our largest cut-worms, and quite peculiar on account of its general bronze appearance, we have characterized it in our notes as the Bronze-colored Cut-worm.

EXTRACTS FROM CORRESPONDENCE.

No Cotton Worm in Eastern Florida yet.—June 28th, examined Mr. St. John's cotton, and fields adjoining; no Aletia.

June 29th, examined Burk's cotton. I have given much attention to this field, as Aletia did much injury here last Sept. ('79). I feel confident that Aletia has not yet appeared. The cotton was planted very early, and the bolls are some of them fully grown. The rust mite is doing considerable damage, and the ground is strewn with dead leaves. There is, notwithstanding, a good show of bolls. I also visited Norton's cotton, which is younger. Norton's orange trees were badly infested with the louse, causing rust on fruit, as I reported May 28th. The damage done is very apparent in the yellow color and dusty appearence of the leaves, but the insects themselves are now much less numerous.—H. G. Hubbard, Crescent City, Fla.

Swellings on roots of Cow Peas caused by Anguillula.—Mr. Carrier's crop of cow peas I reported, some days ago, to be attacked by a disease of the roots, causing them to form tuberous enlargements. These enlargements are solid, succulent, and contain scattered through the tissues, transparent white sacculi, containing germs or cells of some sort. Where rotted, the roots are filled with mites, the gravid females of same color, and nearly or quite as large as the sacks. I, at first, thought it possible that the mites and the sacks were in some way connected; I now think I can make out the young of earth-worms or their embryos within some of the sacks, and I also find young worms already hatched in the tissues. The worms are white, the largest specimens seen perhaps half an inch long. That the worms should be the cause of the enlargement seems to me almost incredible, but if the sacks are truly their egg capsules, their number and regular distribution throughout the entire mass of the tuberous swellings, appears to point to that conclusion. The irregular masses of oblong egg-like cells, found applied to the base of each sack, I am unable to understand. The eggs of the mite are plainly seen in the rotten parts affected by them, and are deposited singly. They are besides quite large and pearly.—H. G. Hubbard, Crescent City, Fla. [The worms belong to *Anguillula*.—ED.]

Destroying Pea Weevils.—A year ago I sent to New York for a small quantity of Dan. O'Rourke peas. When they came to hand, I opened the bag carefully and found them badly infested with the Pea-bug or Weevil. I immediately closed the bag before any of the bugs escaped, then took some kerosene, diluting it about one half with water, and immersed the peas in this a few minutes, and when removed the bugs were all dead. The peas were planted and grew well, and thus far I have seen no other pea-bugs in this part of the country.—Isaac D. Pasca, Meadow Creek, Nevada.

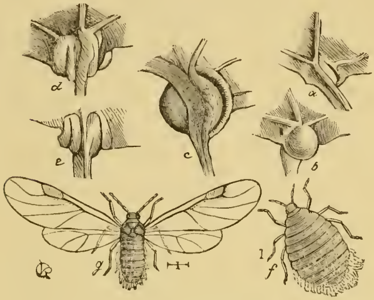
Poplar Stem Gall-lice Fed on by Squirrels.—I send you to-day some galls, with a few lice in some of them. They may not interest you, but to me their work at least seems marvelous. The leaves are from a large *Populus monilifera*, growing in the lawn of Mr. Frank Cornell, of this village. The gall, as you see, is in the petiole. For some reason this yields to the weight of the leaf, and the leaves come floating down in the stillest weather. The ground is almost covered with them. Is this breaking up of the home of the insect an advantage—aiding it in spreading, or will all come to grief whose houses are thus scattered?—W. A. Henry, Ithaca, N. Y., June 14, 1880.

[After stating to Mr. Henry that this falling of the leaves was unnatural, and urging him to try and ascertain the cause, we received the following letter:—ED.]

To-day I settled the question of what opened the galls on the petioles of *Populus*. As hinted in my last letter, it is the work of the common Red squirrel. This morning early three were

busy in one tree climbing out to the tips of twigs, as though after nuts; and, as the second leaf dropped, I easily caught it before it came to the ground. In most instances every inhabitant of the gall had been removed, though now and then one or two were left. The squirrels worked rapidly, and have cut several thousand leaves from one tree.

[Fig. 110.]



POPLAR-STEM GALL-LOUSE: *a*, gall just forming, beneath; *b*, do. above; *c*, perfect gall, beneath; *d*, *e*, young double galls—nat. size; *f*, stem-mother; *g*, winged female—enlarged (after Riley).

This is in the yard of Mr. Frank Cornell. A second tree of the same species, in the Ithaca Cemetery, has had quite a number of leaves cut, but few compared with the first named. At this last there are some shoots growing up about the trunk, and I find many galls upon these opened, but the leaf not cut enough to wither or fall off. If this holds for the whole tree—and I do not see why it should not—they must have opened not less than ten thousand galls on these two trees. Is it generally known that the squirrel is mischievous even to this extent? If not, it might not be out of place to have a note made of it. My observations to-day settle the matter beyond all question, as I saw them cut several dozen leaves, many of which I caught as they fell, and examined carefully.—Ithaca, N. Y., June 24, 1880.

[The gall-louse is the *Pemphigus populicaulis* Fitch, herewith illustrated, Fig. 110.—ED.]

Cotton Worm in Alabama.—I send you slips showing worms, on the 5th inst., in Marengo County, near Macon station, on the plantations of Collins and Pool. Also, worms in Montgomery County, reported by Mr. Kiden on the 10th inst. Also, worms on the Conighead plantation, in Perry County, on the 14th inst.; and continued reports of worms in the cotton fields of Montgomery County up to yesterday. Indeed, I hear of sporadic cases of the appearance in Aletia all along the Prairie belt. The worms are nearly one month earlier than last season. We have had two cool nights, unfavorable to cotton and to worms.—Jas. F. Bailey, Marion, Ala., June 17, 1880.

Cotton Worm in Texas.—The papers in the State report the appearance of the veritable Cotton worm in various sections, but mostly, if not entirely, above the 30th parallel, which may be accounted for by the heavy and continuous rains on and above that line. There are no reports of any on the coast, and none nearer than Lavaca County, on the Sun Set route. But heavy rains have just fallen along the coast line, and we may soon expect their advent.—W. J. Jones, Virginia Point, Texas, June 25th, 1880.

Chinch Bug in Iowa and Minnesota.—North east Iowa and southeastern Minnesota have been greatly infested with Chinch Bugs. They came early in April, and were flying in great numbers about twenty days ago. They commenced laying eggs, but, as we have had a wet spring and summer so far, the eggs are mostly destroyed, and, we hope, many bugs also. But wet weather brings rust. Our wheat is struck with red rust. We are in a strait betwixt two evils. If it's dry, we have the bugs; if wet, the rust.—S. L. Cary, Lime Springs, Iowa, July 1, 1880.

Cotton Worm in Mississippi.—The Cotton Army-worm, the Aletia, has made its appearance here. I have not been able to find the moth, but here are the worms. I find them, though in limited numbers, in the field to-day. They are of all sizes, and I found one already "webbed up." They are in the same place they first appeared last year. Though the cotton is about two (2) weeks later than it was last year, the worms are exactly twenty (20) days earlier.—T. G. Smith-Vaniz, Canton, Miss., June 22, 1880.

Orange Mite in Florida.—In the afternoon I visited a young grove (Mr. Cash's grove) infested by the Rust-mite. The leaves present the same dusty appearance and yellow color as Mr. Norton's. The mites are more numerous than at present on Mr. N.'s trees, but their number has evidently diminished somewhat. They infest both leaves and stem, but are more numerous on the upper surfaces of the leaves, and particularly congregate near the edge shaded from direct sunlight. Some of the older leaves on an infested tree show a brownish coating of rust on their under surfaces, of the same sort as that which appears upon the fruit. That they spread rapidly over all parts of the tree is evident from their presence upon young and growing leaves, which have pushed out since the late rains began. To-day being cloudy, with some rain, the mites seem particularly active. I observed a small orange-colored Dipterous (?) larva upon an infested leaf, and among the mites.—H. G. Hubbard, Crescent City, Fla., June.

Larva of Apatura alicia.—You will be glad to know that I have at last got the larva of *Apatura alicia* from Florida. It is now mature, and quite distinct from *A. celtis*—one solid green, uniform, no spots or bands.—W. H. Edwards, Coalburgh, W. Va., June 28, 1880.

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ANNUAL ADDRESS

Before the Entomological Club of the American Association for the Advancement of Science, by the President, Mr. S. H. SCUDDER, of Cambridge.

It is the good fortune of your President on this occasion to welcome you to his native heath, where our favorite science has been longer, more uninterruptedly, and, perhaps, more zealously cultivated, than anywhere else in the New World. Here, in the last century, Peck studied the Canker-worm and the Slug-worm of the Cherry, and, in late years, *Rhynchaenus*, *Stenocorus*, and *Cossus*—all highly destructive insects. Here lived Harris, who cultivated entomology in its broadest sense, and whose classic treatise was the first important Government publication on injurious insects. Here, to-day, we have two associations for our work, consisting, it will be confessed, of nearly the same individuals, and not many of them, but meeting frequently—one in Boston, the other in Cambridge. Harvard acknowledges the claims of our study in supporting not only an instructor in entomology at its Agricultural School, but a full Professor of the same in the University at large.

Harris attributed to Peck his special interest in entomology, and his first paper, that on the Salt-marsh Caterpillar, appeared in the *Massachusetts Agricultural Repository* only four years after Peck's last, in the same magazine, on Cherry and Oak Insects. How many of us have drawn our first inspiration from Harris? Yet probably not one of our local entomologists ever saw him. The general direction of Harris's studies doubtless arose from the predilections of his instructor; and the unprecedented growth of economic entomology in this country, where it flourishes as nowhere else, must be credited primarily to the influence of Harris's work. With every temptation which the wealth of new material about him could give, or which a very extensive correspondence with naturalists devoting themselves almost exclusively to systematic work, like Say, would naturally foster, he wisely followed the bent given his studies by his early training under Peck, and left a better example and a more generous and enduring influence.

In our own day, the spreading territory of the United States, the penetration of its wilds, and the intersection of its whole area by routes of travel, the wider distribution and greatly increased numbers of local entomologists, as well as the demand for our natural products abroad, have set also before *us* the same temptation to study only new forms and to cultivate descriptive work, to the neglect of the choicer, broader fields of an ever-opening science. It is this danger to which I venture briefly to call your attention to-day, not by way of disparaging the former, but rather in the hope that some of our younger members, who have not yet fallen into the ruts of work, may be induced to turn their atten-

tion to some of the more fruitful fields of diligent research.

We should not apply the term descriptive work merely to the study of the external features of insects. The great bulk of what passes for comparative anatomy, physiology and embryology, is purely descriptive, and is only to be awarded a higher grade in a scale of studies than that which deals with the external properties, when it requires a better training of the hand and eye to carry it out, and greater patience of investigation. We pass at once to a higher grade of research when we deal with comparisons or processes (which, of course, involve comparisons). All good descriptive work, indeed, is also comparative; but at the best it is so only in the narrowest sense, for only intimately allied forms are compared. In descriptive work we deal with simple facts; in comparative work we deal with their collocation. "Facts," said Agassiz, one day, "Facts are stupid things, until brought in connection with some general law."

It is to this higher plane that concerns itself with general laws that I would urge the young student to bend his steps. The way is hard; but in this lies one of its charms, for labor is its own reward. It is by patient plodding that the goal is reached; every step costs and counts; the ever-broadening field of knowledge exhilarates the spirit and intensifies the ambition; there is no such thing as satiety—study of this sort never palls.

It is hardly necessary to point out that so-called systematic work never reaches this higher grade unless it is monographic; unless it deals in a broad way with the relationship and general affinities of insects. It is not my purpose to call attention here to the needs of science in this department, as they are too patent to escape observation; but if one desires a model upon which to construct such work, one need not look further than the Revision of the Rhynchophora by Drs. LeConte and Horn. Rather than linger here, we prefer to pass directly to some of the obscurer fields of study.

When we compare the number of insect embryologists in America with that of their European colleagues, the result is somewhat disheartening and discreditable; although perhaps the comparison would be not quite so disproportionate were some of our students to publish their notes. But take all that has been done upon both sides of the water, and what a meager showing it makes. Of how many families of Coleoptera alone have we the embryonic history of a single species? Of two of the four families of Butterflies, the fertile eggs of which are perfectly easy to obtain, nothing is known. In short, one may readily choose numbers of typical groups whose embryonic history would be a great acquisition to science. Here is a broad field. From the special range of my own studies let me recommend to any one eager for this work to choose the eggs of our common copper butterfly, which she will lay to order on sorrel, and the earlier stages of which can be obtained from the parent at two or three different times of the year; or the eggs of any of our common skippers, which deposit on grass, and which are equally easy to obtain, although only once a year. Or, if we turn to Orthoptera, the eggs of our common *Oecanthus*, concealed all winter in raspberry twigs, are more transparent and more easily obtained than those of any other cricket; and our knowledge of the embryology of any of the *Gryllidae* is very fragmentary, and of this particular tribe, *nil*. Better still, perhaps, would be the choice of our common walking-stick, as it belongs to a bizarre and isolated type, now known to be of very ancient ancestry, and of whose embryonic history nothing has been published. I have, indeed, a few incomplete notes upon this insect, but they relate wholly to a late period of development, and were made before the time of the microtome, when work over such coarse-shelled eggs was very difficult and unsatisfactory. The eggs may be readily procured, the insect being abundant in scrub-oak fields; the mother drops the eggs loosely on the ground, and from imprisoned specimens I have pro-

cured scores in a single season. Any one who will glance over the history of what has been done in insect embryology will be able to select a hundred examples as important and as easy to obtain as those already named, and by concentrating his work upon them will do better service than in an aimless selection of what may come to his hand.

In following the post-embryonal history of insects there is work for all. While allied forms have in general a very similar development, there are so many which are unexpectedly found to differ from one another, that every addition to our knowledge of the life histories of insects is a gain, and they are to be praised who give their close attention to this matter. Here is a field any entomologist, even the most unskilled, may cultivate to his own advantage and with the assurance that every new history he works out is a distinct addition to the science. The importance of an accumulation of facts in this field can hardly be overestimated, and those whose opportunities for field work are good, should especially take this suggestion to heart. Nor, by any means, is the work confined to the mere collection of facts. How to account for this extraordinary diversity of life and habits among insects, and what its meaning may be, is one of the problems of the evolutionist. There are also here some specially curious inquiries, to which Sir John Lubbock and others have recently called attention, and to which Mr. Riley has contributed by his history of *Epicauta* and other *Meloidæ*. I refer to the questions connected with so-called hypermetamorphosis in insects. In these cases there are changes of form during the larval period greater than exist between larva and pupa, or even between larva and imago, in some insects. There are also slighter changes than these which very many larvæ undergo; indeed, it may safely be asserted that the newly-hatched and the mature larvæ of all external feeders differ from each other in some important features. The differences are really great (when compared to the differences between genera of the same family at a similar time of life) in all lepidopterous larvæ, as well as in all Orthoptera which have come under my notice. No attempt to co-ordinate these differences, or to study their meanings, or to show the nature of their evident relationship to hypermetamorphosis has ever been attempted.

Not less inviting is the boundless region of investigation into the habits of insects and their relation to their environment. The impulse given to these studies by the rise of Darwinism, and the sudden and curious importance they have assumed in later investigations into the origin and kinship of insects, need only to be mentioned to be acknowledged at once by all of you. The variation in coloration and form exhibited by the same insect at different seasons or in different stations, "sports," the phenomena of dimorphism, and that world of differences between the sexes, bearing no direct relation to sexuality; mimicry also, phosphorescence and its relations to life, the odors of insects, the relation of anthophilous insects to the colors and fructification of flowers, the modes of communication between members of communities, the range and action of the senses,* language, commensalism,—these are simply a few topics selected quite at random from hundreds which might be suggested, in each of which new observations and comparative studies are urgently demanded.

The fundamental principles of the morphology of insects were laid down by Savigny in some memorable memoirs more than sixty years ago; the contributions of no single author since that time have added so much to our knowledge, notwithstanding the aid that embryology has been able to bring. Nevertheless there remain many unsolved problems in insect morphology which by their nature are little likely to receive help from this source. Let me mention three:

The first concerns the structure of the organs of flight. The very nomenclature of the veins shows the disgraceful condition

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* Notice Meyer's beautiful studies on the perception of sound by the mosquito.

of our philosophy of these parts; the same terminology is not employed in any two of the larger sub-orders of insects; names without number have been proposed, rarely however by any author with a view to their applicability to any group outside that which formed his special study; and a tabular view which should illustrate them all would be a curious sight. A careful study of the main and subordinate veins, their relations to each other, to the different regions of the wing, to the supporting parts of the thorax and to the alar muscles, should be carried through the entire order of insects; by no means, either, neglecting their development in time, and possibly deriving some assistance in working out homologies by the study of their hypodermic development.

The second concerns the mouth parts. The general homologies of these organs were clearly and accurately enough stated by Savigny, though one may perhaps have a right to consider the last word not yet said when one recalls Saussure's recent claim to have found in *Hemimerus* a second labium. What I refer to, however, is another point: it relates to the appendages of the maxillæ and the labium. Considering the labium as a soldered pair of secondary maxillæ we have at the most, on either pair of maxillæ, three appendages upon either side. These appendages, as you know, are very variously developed in different sub-orders of insects, or even in the same sub-order; and it has at least not been shown, and I question if it can be done, that the parts bearing similar names in different sub-orders are always homologous organs. Here is a study as broad and perhaps as difficult as the last.

The third is the morphological significance of monstrosities, especially of such as are termed monstrosities by excess. The literature of the subject is very scattered, and the material much more extensive than many of you may think. At present this subject is, so to speak, only one of the curiosities of entomology, but we may be confident that it will one day show important relations to the story of life.

After all the labors of Herold, Treviranus, Lyonet, Dufour, and dozens of other such industrious and illustrious workers, is there anything important remaining to be done in the gross anatomy of insects? some of you would perhaps ask. Let the recent work of some of our own number answer, which has shown in the Hemiptera and Lepidoptera the existence of a curious pumping arrangement by which nutritious fluids are forced into the stomach. It is certainly strange that after all that has been said as to the mode in which a butterfly feeds, that no one should have dissected a specimen with sufficient care to have seen the pharyngeal sac which Mr. Burgess will soon show us. No! the field is still an open one, as the annual reviews clearly show. The curious results of Flögel's studies of the brain, the oddly-constructed sense-organs found by Graber and Meyer (earlier noticed briefly by Leydig) in the antennæ of Diptera, the important anatomical distinctions discovered by Forel in different groups of ants, the strange modification of the tip of the spiral tongue in *Ophideres*, which Darwin, Brietenbach and Künckel have discussed, and, above all, the extensive investigations of the nervous system in insects generally, which Brandt has recently undertaken, the exquisite memoir of Greenacher on the structure of the compound eye, and the keen researches of Graber in various departments of insect anatomy, show, by what has been accomplished, how many harvests are still unreaped. The microtome, too, has put a new instrument of precision into the hands of the investigator in the field.

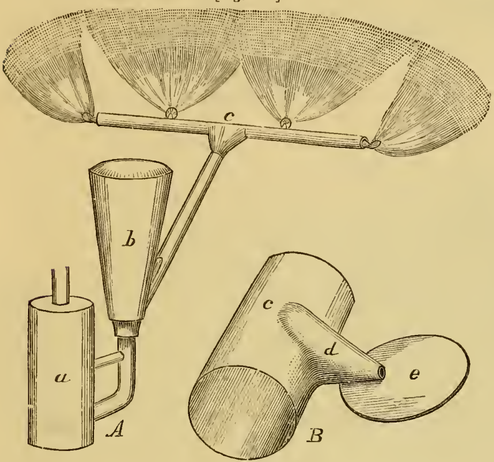
We might in the same way point out some of the special needs in the study of the finer anatomy or histology of insects, but the pressure of other duties forbids a further pursuit of the subject. Enough surely has been suggested, even in this hasty sketch, to show that we cannot yet rest upon our oars, but must push forward undaunted into still unknown waters. If these few words shall arouse in any one a higher ambition, leading to better work, their aim will have been accomplished.

SPRINKLERS AND ATOMIZERS.

(Concluded from p. 189.)

"The Warner Saddle Sprinkler.—A device very well spoken of and advertised as the saddle sprinkler has been perfected by Mr. Jackson Warner, Austin, Tex. The liquid is contained in a bag which is used on the back of a mule or horse as a saddle, the liquid being forced out by the action of the feet. I have not been able to see either the contrivance or any specification of it.

[Fig. 111.]



The Binkley Atomizer.

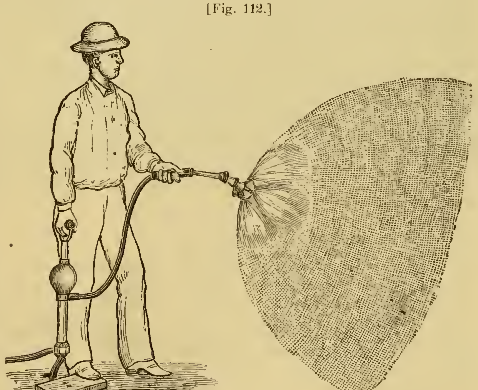
"The Binkley Atomizer.—This sprinkler, invented but not patented by Mr. J. N. Binkley, of Columbus, Tex., and herewith illustrated, is one of the simplest and yet one of the best in use. Fig. 111, A, represents it in operation with a part of the pump. This pump is the usual double-acting force-pump secured to the top of a barrel containing the liquid. The letter *a* represents the pump cylinder, *b* the air chamber, and *c* a transverse tin pipe connected with the discharge pipe of the pump and having four of the atomizing nozzles. Fig. 111, B, shows a side view of the atomizer on a somewhat larger scale. A conical tin piece, *d*, is soldered to the pipe *c*, having at its end an orifice much larger than the fine perforations of the previous machines described. A circular tin plate, *e*, is soldered to the lower side of the cone *d*, so that the jet of water issuing with great force from the orifice, strikes the plate at an obtuse angle and is scattered in very fine and far reaching spray. The large orifice permits smaller objects to be thrown out with the jet, larger objects being prevented by a strainer from entering the pump, while by a slight bending of the distributing-plate, so as to bring it at more acute angles with the nozzle, the spray may be thrown more and more upward. The whole machine is very light and simple and easily made by any tinsmith at comparatively trifling cost. The principal drawback to it as at present constructed by Mr. Binkley is that it is made in one piece, so that in case a larger object obstructs the orifice there is some difficulty in removing the same.

"This defect could be easily remedied by making the cone in two pieces, the nozzle itself to be screwed on to the basal or soldered piece. The plates and the orifices should be thoroughly cleansed and dried after use, in order to prevent rusting. The machine with four spouts, as in the figure, throws the spray over six or seven rows, but its capacity is easily increased by lengthening the transverse pipe (*c*). Its cost is less than $10.

"After witnessing this machine in operation, I am satisfied that the atomizing principle is a most valuable one, and that with modified conducting pipes or tubing, so as to throw the spray from near the ground up into the plants and on the under surface of the leaves, as in Mr. Daughtrey's machine (see p. 213), it will give great satisfaction because of its cheapness and simplicity.

"The Schier Atomizer.—This atomizer was recently perfected by Mr. John Schier, of Ellingen, Tex., and is on the same general principles as the preceding. For the spraying arrangement proper a patent was obtained October 2, 1879. In the accompanying illustration (Fig. 112) it is represented in operation, attached to a small hand-pump such as is commonly used throughout the country. The pump is to be connected by a hose with a vessel containing the liquid, and the whole machine to be operated from the rear part of a cart drawn through the field. At Fig. 113 I have given an enlarged view of the atomizer and mode of attachment, and at Fig. 114 the same

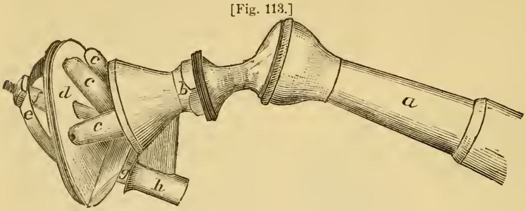
[Fig. 112.]



The Schier Atomizer.

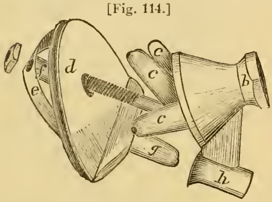
with the distributing-plate disconnected, so as to show the mode of adjustment.* The nozzles *c c c* are connected with the conducting pipe (*a*) by means of a nut (*b*), and throw the liquid on to a distributing-plate (*d*) of brass, backed and strengthened by an outer layer of tin. This plate is secured in place by means of a screw soldered beneath the nozzles, running through a tube connected with and rendered firm by a bow (*e*) soldered at each end to the outer layer of the plate. The screw issuing from this tube receives a nut; while still greater security is given to the plate by a projection, *g*, beneath, which fits into a tube (*h*) attached to the nozzle-piece. The liquid, therefore, strikes the plate at an obtuse angle, but instead of one jet of liquid, as in the Binkley sprinkler, Mr. Schier brings three to bear on the same plate, the orifice of each nozzle being as large as the head of an ordinary pin. This sprinkler can be operated either as shown in Fig. 112 or fastened to a frame on a cart. When the distributor is held down the spray is directed upward, and it can therefore be used for spraying the under side of the leaves.

[Fig. 113.]



THE SCHIER ATOMIZER: nozzle and distributor connected.

[Fig. 114.]

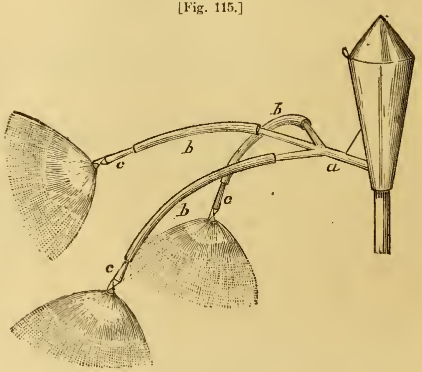


THE SCHIER ATOMIZER: nozzle and distributor disconnected.

"The peculiarity of this machine consists in the fact that with an exceedingly small and light instrument an efficient spray can be produced that reaches over five rows of cotton, the strength of the distributing apparatus being such as to warant great concentration of pressure. The contrivance may be considerably simplified, and Mr. Schier, who calls his atomizer the "Diana Cotton Sprinkler," is now perfecting a machine that will supply three of these atomizers and cover sixteen rows of cotton at once, so that in one day from 150 to 200 acres may be poisoned.

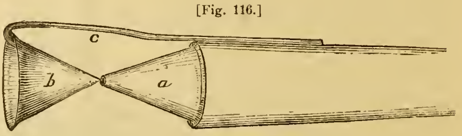
"RUHMANN'S IMPROVED ATOMIZER.—For his improved sprinkler, a patent of which has been applied for, Mr. Ruhmann uses the same pump and tripartite discharge-pipe already described and figured (Figs. 96 and 115*a*), and the improvement consists in an entirely new arrangement for producing the spray. In Fig. 115, which shows the improved sprinkler in operation, the letter *a* represents the discharge-pipe, *b b b* three rubber tubes (each about one foot in length, with the intermediate somewhat shorter) that connect the three arms of the discharge-pipe with the nozzles or sprinklers proper, *c c c*. One of these is represented on a larger scale in Fig. 116, and consists of a tin pipe about eight inches in length and somewhat funnel-shaped, in order to fit tightly in the rubber tube. To the anterior end of this pipe is soldered a conical nose, *a*, having an orifice of about the size of an ordinary pin-head, or large enough to prevent clogging by minute obstacles, larger ones being prevented from entering the pump by the strainer connected therewith (Fig. 95). Opposite this orifice, and almost touching it, is the point of another conical, hollow piece, *b*, with a slightly dilated or recurved rim, and held in position by a stout wire, *c*, soldered on to its edge and to the side of the tin pipe. The liquid, issuing with great force from the orifice, strikes the point of the hollow cone, and is carried in all directions along its sides, when, by striking the bent rim, it is scattered in a bell-shaped spray.

[Fig. 115.]



RUHMANN'S IMPROVED ATOMIZER: in operation.

[Fig. 116.]



RUHMANN'S IMPROVED ATOMIZER.

"With these three atomizers the spray may be distributed over seven rows in calm weather, and over nine rows if the wind be favorable. The price of the machine, including the pump, is $7.50. This form of sprinkler has also the

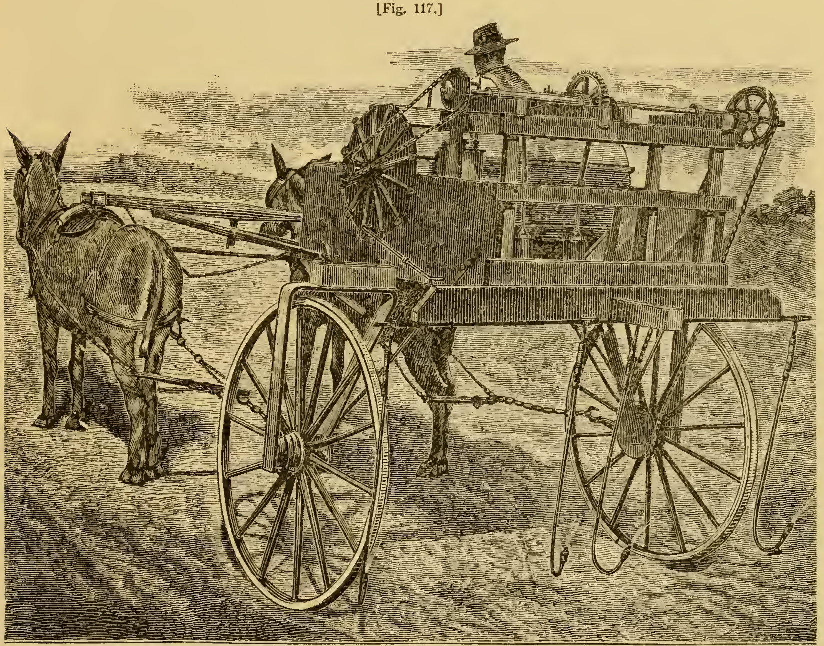
* Mr. Schier writes that in his sprinkler, as it is patented, there is an additional arrangement for conducting back the liquid that drips from the plate.

advantage that it may be used to distribute the liquid from below. For this purpose the rim of the distributor should be bent back so as to form a more acute angle. Other changes necessary for this purpose have already been indicated in treating of previous machines.

"There is no doubt but that these three atomizers last described are all valuable as embodying a simple principle which may be made use of at comparatively little cost, and both to throw the spray on the plants above or up among them from below. That they have, in these respects, a decided advantage over all the other contrivances mentioned will admit of no doubt.

"THE DAUGHTREY ATOMIZER.—There still remains one machine to be described in this connection which is highly interesting for several reasons: 1st, because it is the only one actually in use for the distributing of liquid from below; 2d, because the construction of the pump is quite peculiar; and, 3d, because the arrangement for producing the spray is not only entirely different from any described in the foregoing pages, but also most simple. This machine was invented by Mr. William J. Daughtrey, of Salem, Ala (patent No. 200,376, February 19, 1878). The accompanying sketch (Fig. 117) represents it as it appears. It consists in the main of a pump, which is made self-operating by means of a pulley, and which forces air into the receiving tank and into a compression cylinder connected therewith, thus supplying the pressure necessary for the spray. As will be seen from the sketch, a transverse distributing pipe is connected with a number (four in the sketch) of vertical pipes recurving at the ends, which receive the nozzles, one of which is represented in section in the accompanying Fig. 117. The nozzle N, which is screwed to the pipe; has a closed end, *n*, provided with two openings, n^1, oppositely inclined, so that the jets delivered through them meet at a point near *n* and deflect and disperse each other so as to form an extremely fine spray. The openings n^1 are large enough to avoid being obstructed by small obstacles, and the spray produced by the two inclined jets is at once copious and powerful."

[Fig. 117.]



THE DAUGHTREY ATOMIZER.

The spray machine above described which breaks the water into particles by obstruction, illustrate a valuable principle, which admits of great variety and adaptation in its application. The principle of the Daughtrey nozzle is that of the old-fashioned gas-burner, viz., two jets crossing each other. That of the ordinary fish-tail burner, which sends the flame through a rounded slit, is still better. It has been used for the first time this season, and promises to supersede all others. The

principle of forcing the liquid through a crescent-shaped slit or broad lips of various dimensions, whether cut into a moulded nozzle or made by soldered pieces of tin or zinc, is a most valuable one, not only because of the fineness of the mist that can be produced, but because of the reduced risk of filling up or clogging.

FURTHER NOTES AND OBSERVATIONS ON THE ARMY WORM.

[*Concluded from p.* 185.]

HOW FAR IS BURNING OVER A PREVENTIVE.

That fields which have been burned over in the winter are free from the destructive presence of the worm is a fact in the history of its visitations. But opinion has varied as to the precise effect produced by the burning over. I have shown that it destroys the appropriate nidus for the laying of the eggs by the moth in the spring. Now that larval hibernation is established, we can readily see that the fires would destroy these hibernating larvæ and prevent the appearance of the moths and of a second destructive brood from them. But we must not suppose that the burning over would prevent *all* appearance of the worm; it merely prevents its appearance in destructive numbers. The moth will, when exceptionally numerous, lay her eggs without concealment and upon plants, such as clover, which the larva does not relish.* In such cases of exceptional abundance we may well suppose that the moth will fly into fields which had been burned over and supply them with eggs, but the instances in which this would result in material damage to the crop would be very rare.

CONNECTION OF WET AND DRY SEASONS WITH ARMY WORM INCREASE.

That the army worm appears in destructive numbers after a period of dry seasons is a fact already recognized, and is in accordance with the experience of the present year. The portions of our country visited by the worm this year were afflicted with drought last summer, and the winter was remarkable for its mildness and the slight fall of snow. Fitch's theory of the appearance of the worm required that this spring should be a wet one in order to drive the moths from the swamps and cause them to lay their eggs on the upland. But the facts are just the reverse. Farmers from Virginia to Vermont have complained loudly of the excessive drought. Rivers in some of the Atlantic States have not been so low for a generation, and alluvial meadows which have been subject to a spring flooding, have this year remained dry. These facts clearly disprove Fitch's theory, and we must believe that the army worm is most likely to appear after dry seasons, *regardless* of the wetness or dryness of the season in which it occurs. A critical examination of Fitch's arguments in support of his theory shows that he not only had no personal acquaintance with the worm, but also made some false meteorological deductions, such as comparing the rainfall of India (?) with the appearance of the worm here. With equal reason might we argue that 1879 was wet in our Atlantic States because of the excessive precipitation in the British Islands during that year. It is evident that Fitch was hard pressed for arguments to support the theory. That the season of 1861 was remarkably wet in the Eastern States, Fitch gives no evidence, and while the mean rainfall, according to statistics was greater in 1861 than in 1860, it does not follow that the spring and early summer of 1861 were, on that account, unusually wet. From the well known connection of the presence of plant lice with dry seasons, and from the memorable depredations of the grain aphis in that year throughout the Middle and New England States, it is very questionable whether the summer of 1861 was wet. It is far more probable that the season was a dry one like the present, in which also various plant lice have done great damage.

The view that the army worm has its

* I have recently received from Prof. Lintner, State Entomologist for New York, what are apparently the pressed eggs and egg shells of this moth, thickly covering clover leaves, and mixed with an abundance of white gummy matter, with which the moth usually secretes them, all indicating that in this instance the moths (doubtless from excessive numbers) had "slopped over." Prof. Comstock likewise informs me that he has found the eggs laid between the folded lobe of a clover leaf.

proper home in the wild grasses in the swamps, as Fitch has assumed, must also be considered erroneous. The moth prefers matted grass amid which to lay her eggs, and the more tender grasses are those first selected by the worms. Old, neglected fields, whether their location be low or high, are the most natural breeding places for the insect. That the worms most often appear in low lands, or in the neighborhood of such, doubtless finds more correct explanation, first, in the highly probable fact that the parent moth gets more appropriate food at such places, either in saccharine exudations, the natural "sweat" of the plants, or moisture from the ground; secondly, in the well observed fact that such lands afford the greatest extent of neglected meadows where the insect has opportunity to multiply unnoticed and undisturbed.

THE FOOD OF THE BLUEBIRD (Sialia sialis, L.).

BY PROF. S. A. FORBES, NORMAL, ILL.

This beautiful and beloved bird, endeared to the student of nature by every particular of its plumage, song, and way of life, is also one of the most popular of all birds with farmers and gardeners. Living under the eyes of men from the first yielding days of the later winter until the year grows chill and dark with the retreat of autumn, it has been praised most warmly for its tireless service of man by those who knew it best. A cursory observation of its feeding habits will strongly support the general impression of its usefulness. Most frequently it takes a short, quick flight to the ground from a fence-post, or a low branch of a tree, and, after a moment's pause, returns to its perch with a caterpillar, or a grasshopper, or some other insect in its beak, which it devours at its leisure, repeating this operation so frequently that none can doubt its enormous destructiveness to insect life.

It is true that a little reflection will suggest that, as it evidently sees its prey before it leaves its perch, it must usually take only the most conspicuous and the most active insects, and that there is no security that these will be the most injurious—that they may not be, in fact, among the most beneficial; but this consideration does not seem to have made any impression, and the Bluebird remains to this day substantially without reproach.

It is not a pleasant task to cast the first aspersion upon this gentle little bird, so universally admired; but the injuries of which it must be accused are not of a kind likely to seem very important to the general public, and, at any rate, the truth is better than error, even about a Bluebird.

I have now examined carefully, with the microscope, the contents of eighty-six stomachs of this species, of which ten were taken in February, twenty-one in March, thirteen in April, nine in May, ten in June, nine in July, two in September, and twelve in December (in Southern Illinois). I propose to present the data for each of these months; to summarize them for the year; to estimate the benefit and injury indicated to farm and garden, and to make a comparison of the food of this bird with that of the robin, and of the thrushes generally.

FEBRUARY.

The ten birds of this month were all shot at Normal, Ill., from the 24th to the 29th of the month, in the present year. These stomachs, with those obtained from Galena, in early March, represent the first food of the season.

The record opens with a bird shot on the 24th. Thirty per cent. of its food had been grass-eating cut-worms, 40 per cent. crickets (*Gryllus abbreviatus*), 5 per cent. *Ichneumonidæ* (*Arenetra nigrita* Cress), and 25 per cent. the larvæ of the two-lined soldier-beetle (*Telephorus bilineatus*). Now, the Ichneumons are doubtless parasitic, although about the habits of the genus *Arenetra*, I have at present but little specific information, and the soldier beetles are reported by Prof. Riley and others to be highly useful insects, noted especially for the destruction of the Apple-

worm and the eggs of grasshoppers.* Surely this first bird has not distinguished itself by its possibly well meant, but, at any rate, very unfortunate attack on the insects of the field.

Taking the month together, we find that the most important elements of the food were cutworms and ichneumons—24 per cent. of the former to 22 per cent. of the latter. The larvæ of the soldier beetles amount to 8 per cent., locusts (chiefly the young of *Tragocephala viridifasciata*) to 9 per cent, Carabid beetles and their larvæ (including *Amara* and *Anisodactylus*) to 5 per cent., *Cydnidæ* or Soldier-bugs (chiefly *Euschistus servus*) to 7 per cent., spiders to 4 per cent., and *Iulidæ* (thousand-legs) to 3 per cent. Other items are, 2 per cent. caterpillars of Arctians (*Callimorpha lecontei*), 4 per cent. crickets, and 9 per cent. dung beetles (*Aphodius fimetarius* and *A. inquinatus*). The ichneumons, Carabid beetles, soldier bugs, and spiders, thus make up 46 per cent. of beneficial insects, while the caterpillars and Orthoptera amount to but 41 per cent. of injurious species. Or, if we drop the *Cydnidæ* from the former category, on account of the supposed trifling injuries to vegetation done by some of them (hence often called "plant bugs"), the figures will stand, beneficial insects 39 to 41 injurious. But this is not all. Mr. Walsh, reasoning from the comparative numbers of injurious and beneficial insects, concludes that a bird must be shown to eat at least thirty times as many injurious individuals as beneficial before it can be considered useful ;† but at five times as many, or even *twice* as many, these bluebirds fall far short of establishing their claim to recognition as defenders of the farm and garden.

MARCH.

Twenty-one specimens were examined which had been shot in this month, in 1880, ranging from the 7th to the 31st. Seven of these were shot at Normal, nine at Heyworth (15 miles south), and five at Galena, in extreme north-western Illinois. These latter differed from the central Illinois specimens chiefly in the presence of the dried and sometimes moldy fruit of the sumach (*Rhus glabra*) in their stomachs, indicating a scarcity of desirable food at that early season. One of these, unfortunately for the record of the month, had stuffed itself with the larvæ of *Harpalus*, which made 93 per cent. of its food.

Ichneumonidæ (*Arenetra*) appear again (4 per cent.) for the last time during the season.

Harpalid beetles and their larvæ were unusually abundant, making up 11 per cent. of the food of the month. Among these, *Platynus*, *Evarthrus*, *Pterostichus*, *Amara*, *Chlænius tomentosus*, *Agonoderus*, and *Harpalus* were recognized. The larvæ of soldier beetles also occur, constituting 4 per cent. of the food, but do not appear again throughout the year. Four birds had eaten a predaceous bug (*Coriscus*, near *ferus*), which is too minute to figure in the ratios ; and 4 per cent. of the food was *Cydnidæ*, of which only *Peribalus modestus* was recognizable. Sixteen of the twenty-one birds had eaten spiders, making 5 per cent. of the food. The beneficial insects thus amount to 28 per cent. On the other hand, 38 per cent. was caterpillars (chiefly *Noctuidæ**), including *Callimorpha lecontei*, and the army worm (*Leucania unipuncta*), 1 per cent. was *Euryomia inda*, and 21 per cent. was Orthoptera (crickets and grasshoppers), the injurious species thus rising to 60 per cent. One bird had also eaten a minute curculio. Among neutral elements we enumerate *Aphodii* 3 per cent., *Iulidæ* 3 per cent., and sumach berries 4 per cent. Two birds had eaten ants, but in trivial quantity.

In order to determine the number of specimens which it is necessary to examine in each month, to reach reliable averages of benefit and injury, I divided my notes on twenty of the specimens for March, into two groups of ten each, so selected

* See 4th Rept. State Entomol. of Mo., p. 29, and Rept. U. S. Ent. Com. 1877, p. 302.

† *Birds* vs. *Insects*. Practical Entomologist, vol. 2, pp. 44—47.

* I have thus reported all smooth caterpillars in which the cervical and anal shields, common to most cut-worms, were distinguished. A few such caterpillars are not Noctuids, but all are equally injurious.

that all the localities and all parts of the month were equally represented in each group; and then averaged each ten separately, and compared the averages. In the first group beneficial insects composed 29 per cent. of the food, and injurious insects 59 per cent.; in the second group beneficial insects composed 27 per cent. of the food, and injurious insects 61 per cent. The close correspondence of these averages shows that, on this question, ten specimens would have given as accurate information as twenty, and indicate that ten birds a month will usually afford a fair basis for an opinion.

APRIL.

The food of April, as shown by the thirteen specimens of that month (from Normal, Evanston, Waukegan, and Elizabeth, in 1876 and 1880), was remarkable for the number of *Aphodii* (dung beetles) it included; 21 per cent. of the food of the month was *Aphodius inquinatus*, 9 per cent. *A. fimetarius*, and 1 per cent. undetermined *Aphodii*. This peculiarity is accounted for, in harmony with what has been said above respecting the feeding habits of the Bluebird, by the fact that this is the month when the *Aphodii* fly most actively in the latitude of Northern Illinois. *Carabidæ* now stand at 8 per cent., including *Carabus palustris*, *Pterostichus*, *Evarthrus*, and other *Pterostichi*, *Platynus*, *Chlænius tomentosus*, *Anisodactylus rusticus*, *Amphasia interstitialis*, and *Harpalus*; 4 per cent. of Hemiptera include *Coriscus** and *Hymenarcys nervosa*, while spiders rise to 9 per cent. Caterpillars are 21 per cent. (17 per cent. Noctuids), June beetles (*Phyllophaga*) 2 per cent., *Curculionidæ* 1 per cent., and grasshoppers (*Tetiigidea* sp. and *Tettix ornata*) 8 per cent.; a total of 32 per cent. of injurious insects against 21 per cent. of predaceous species. Among the neutral elements we find a sprinkling of ants (2 per cent.), larvæ of a Tenebrionid (*Meracantha contracta*†) 4 per cent., and thousand-legs *Iulidæ* 1 per cent. Long strips of grass, in pieces much too large to have been eaten by any of the insects present, were found in the stomachs of two of these birds, and also occurred during each of the three following months. I am in doubt whether these were taken as food; but, since I have found them in no other bird, and since a species which feeds so largely on cut-worms and grasshoppers may have acquired the power of digesting the very considerable quantities of grass contained in the intestines of these insects, I have thought it best to include them in the percentages of food. It is probable, however, that they were swallowed accidentally with insects taken from the ground.

It will be noticed that the excess of Coleoptera in April is largely compensated by the diminished quantities of orthoptera and caterpillars.

MAY.

In this month nine birds were taken, from six localities in central and northern Illinois, in 1876–'80. The Lepidoptera, Coleoptera, and Orthoptera return to about their normal ratios, but spiders rise to the excessive figure of 21 per cent. This ratio is, however, partly misleading, as, although six of the nine birds had eaten spiders, yet 11 per cent. is due to a single bird, which had eaten nothing else. In such a case a larger number of specimens is required to restore the balance, so violently disturbed. Two birds of this month had eaten moths, and five had eaten cut-worms. The averages stand 55 per cent. of moths, caterpillars, June beetles, curculios and orthoptera, opposed to 35 per cent. of *Carabidæ*, soldier bugs and spiders. The *Carabidæ* include *Cratacanthus dubius*, *Agonoderus comma*, *Anisodactylus*, and *Harpalus*. Other details may be obtained from the table at the close of this paper.

JUNE.

In June, ten birds—one from Mount Carroll, the others from Normal—had taken a somewhat unusual diet. The ratio of spiders (18 per cent.) falls little short of that for May; but an examination of

* Kindly identified for me by Mr. Uhler.

† For the determination of this species and most of the other larvæ which have been identified specifically, I am under obligations to Prof. Riley, without whose most generous assistance this paper would have lacked much of whatever value it may be supposed to have.

the notes shows that here, too, a single bird had eaten nothing else. Ants rise suddenly from 2 per cent. in May, to 20 per cent. in June, taken by six of the birds. Most of these, however, were of the winged forms, and their number is evidently due to the same cause which rendered the *Aphodii* so abundant in April. Three of the birds of June proved, to my surprise, to have eaten raspberries, and one gooseberries—these fruits amounting to 8 per cent. of the food of the month. No cut-worms were recognized in June, but measuring worms (*Phalænidæ*) replaced them, composing 6 per cent. of the food. While all the cut-worms found in any month whose food was at all distinguishable had eaten nothing but grass—or endogenous foliage, more accurately speaking — several of these *Phalænidæ* had been feeding on netted-veined leaves. The *Harpalinæ* (6 per cent.) include *Evarthrus*, sp., *Pterostichus lucublandus* and *Anisodactylus baltimorensis*. June beetles (*Phyllophaga*) had been eaten by one bird, a *Melanotus*, a curculio, and a long-horn beetle (*Tetraopes tetraophthalmus*), each by one. *Cydnidæ* reach 5 per cent., chiefly *Hymenarcys nervosa*, and Orthoptera fall to 3 per cent. The excess of ants is therefore taken, like the excess of *Aphodii*, from the caterpillars and grasshoppers.

The averages of beneficial and injurious species stand 30 per cent. to 26 per cent., respectively. Regarding ants, I find such conflict of opinion among good authorities, that I am not able to give them a definite place on either side the line. The injury to fruits is probably too insignificant to be taken into account, except as evidence that the species is not strictly insectivorous, even in midsummer.

(To be continued.)

SUPPLEMENTARY INSTRUCTIONS TO AGENTS OF THE U. S. E. C.

We draw the attention of our readers to the following instructions to agents of the U. S. E. C., sent out as supplementary to the printed circular issued in June, in the hope that others besides those employed by the Commission may be induced to make such observations and experiments as the instructions suggest:

OFFICE OF THE U. S. ENTOMOLOGICAL COMMISSION,
1700 13th St., N. W., Washington, D. C.,
July 30th, 1880.

In addition to instructions already transmitted to you, I hereby call your attention to a few important points, which should have especial attention.

In the application of poisons already known to be effectual, the great desideratum is to ascertain the minimum quantity that can be used successfully. It is my intention to perfect appliances that will throw either an extremely fine mist or an almost impalpable cloud of dust from near the ground up among the plants and on the under side of the leaves.

Test, therefore, thoroughly, by a series of accurate experiments, whether:

1st. London Purple, Paris Green, or Arsenic can be used without diluents, by forcing them dry in minimum quantity on to the plants, and ascertaining how much ground a pound of each may be made to cover.

2d. If they cannot be used without diluents, the minimum quantity of such diluents necessary.

3d. How far, by finer spraying and economy in preventing wastage on the ground, the number of gallons of water to a pound of these materials may be reduced—the idea being in all these desired experiments to reduce the bulk and expense of the diluents by forcing the poisons in finer and fewer particles up among the plants (rather than down upon them) through small perforations, or (what will prove preferable) crescent-shaped slits of various dimensions in nozzles that will bear great pressure from within.

4th. Test how far, *i. e.*, over how much ground, on the above principles, a pound of Pyrethrum may be made to go and still prove effectual.

5th. Ascertain, if possible, whether the moths are not killed by sucking at the glands, where the plant is poisoned from below.

6th. Ascertain the effect of these different poisons on the eggs.

7th. Always note the difference in effect on the very young and the full-grown worms.

8th. Observe well in the woods and in the neighborhood of infested fields if the Aletia larva can be found feeding on any other plant, searching particularly plants of the same family (*Malvaceæ*), as that to which cotton belongs.

9th. Note and study any mites found preying on the eggs.

10th. Send me a summary of the experiments made with yeast ferment, or beer mash, as soon as they are completed.

11th. Study well the influence of ants in the cotton field, and in how far they prove destructive to Aletia, especially to the eggs, or young larvæ.

Respectfully,

(Signed) C. V. RILEY,
Chief U. S. E. C.

Mr. Herbert H. Smith, whose excellent book on Brazil recently appeared, has promised the Cornell University a set of Brazilian Insects, including 1,000 species chiefly beetles.

NOTES ON THE USE OF THE OVIPOSITOR IN THE LONG-STING ICHNEUMONS OF THE GENUS RHYSSA.

BY J. QUAY.

A beech stump, in a slightly decayed condition, has furnished me the means for an interesting observation.

It was situated near the edge of a piece of woods, and when first seen was covered with nearly a score of *Rhyssa atrata* (see front page of Entomologist) and *lunator* busily engaged in their duties of boring or rather drilling for the larvæ of *Tremex*.

As I had seen no published account of their manner of operation, by which the long ovipositor could be brought into position, the manifestation of it was to me new and quite strange.

The ovipositor of some of these specimens measured, not 3 to 4 inches as Harris has stated in his work, but 5½ inches. This extreme measurement came from the black species or *atrata*. As these insects, by standing on "tip-toe" and elevating their abdomen to its fullest height, can clear but about 2 inches space, the problem presents itself as to how can the remaining 3 inches of ovipositor be disposed of in order to allow the drill end to enter the perforated stump.

I observed that after raising the abdomen as far as possible, the drill was worked forward so as to slightly bend under, giving the insect a purchase on same. Then followed a bearing down motion on the bent tube, curving the end of the abdomen forward and upward, and next forcing the ovipositor, near its attached end, to curve also and pass up through the abdomen, and above, into a cavity which there opened for its reception.

What a strange provision of nature!

The cavity was enclosed by a membranous sack, capable of great distention, and while the drill was being continually forced up through, it curled about within the sack forming one complete bend of about ⅘ inch in diameter, and another partial one. When fully distended, the sack was very thin, quite transparent, and seemingly upon the point of bursting apart. But the ovipositor was in this manner brought to the edge of the worm-hole, was slipped in, and thus made to ease away upon the distended sack which by collapsing forced out again the drill by its mere force of contraction. The coil now soon disappeared, and the insect was fully prepared to commence operations upon the hapless *Tremex*.

I found one poor *atrata* which could not, because of some defect, force the sack opening to part to reçeive the ovipositor. Her ingenuity in endeavoring to do so was quite remarkable. The tube would be bent under as far as possible, and then the whole weight of body and power of the limbs be brought into action to force the opening. It proved useless; the force used usually causing the tube to slip back and straighten out behind. Then she would leave the locality or opening in the stump that she had selected by her antennæ with great care, and seek a lichen or mossy spot in hopes of obtaining better control of the tube. Failing here also she would become quite frantic in her efforts, throwing herself squat down upon the tube and twisting about sideways, and endeavoring by several ingenious movements to accomplish her purpose. Becoming at length quite exhausted and worn out, her hold would loosen and she would fall to the ground. Here regaining strength she would climb back but to repeat the same failure, until my net enclosed her tired body, and my bottle of benzine asphyxiated her forever.

DIMORPHISM IN LOCUSTS (Acrididæ.)

BY THE EDITOR.

In our contemporary, the *Canadian Entomologist*, for April of the present year, Mr. S. H. Scudder has an interesting communication on this subject, giving it as his belief that many of the insects that have been described under the genus *Pezotettix* are but short-winged forms of *Caloptenus*. He says: "*Pezotettix plagosus* Scudd. and *Caloptenus Turnbulli* Thom. are to be referred to the same species; *Pezotettix abditum* Dodge and *Caloptenus junius* Dodge

seem to belong together; the same may be said of *Pezotettix nigrescens* Scudd. and *Melanoplus clypeatus* (*Caloptenus clypeatus* Scudd.); *Pezotettix scudderi* Uhler resembles *Melanoplus glaucipes* Scudd. at a further remove; while not only is *Pezotettix enigma* Scudd. apparently merely a short-winged form of *Melanoplus collaris* Scudd., but *Pezotettix jucunda* Scudd. is perhaps only an impoverished form of the same, with still shorter tegmina."

Mr. Scudder first drew attention to the fact that some of our so-called species of *Pezotettix* are dimorphic forms of *Caloptenus*, before the Entomological Section of the Boston Society of Natural History at its sitting, March 27, 1878. Though there is no reference to our previously expressed opinion on the same subject in either of his communications, we think we can rightfully claim priority in the conclusion, as already in 1876 (see Missouri Entom. Report VIII, p. 115, note), in discussing the variation in different species of *Acrididæ*, we remarked: " During the past year have collected very largely of the commoner species in this Family, and I unhesitatingly assert that, with few exceptions, minute relative measurements of parts or minute colorational descriptions from a few individuals are of little value; and that in Calopteni particularly, specimens taken from the same locality show such variation, and so connect with other species through these variations, that there is no proper way of defining except by the average differences of large numbers. Not only would many supposed species vanish by this method, but many genera also; for I have good reason to show that in several cases, species described under the genus *Pezotettix*, are but short-winged forms of *Calopteni*."

We have in our cabinet what are, beyond much doubt, *Pezotettix* forms of *Caloptenus femur-rubrum*, *C. differentialis*, *C. bivittatus*, *C. robustus*, and finally *C. spretus*, but the whole subject needs fuller treatment by some competent authority, like Mr. Scudder, who has the best knowledge of these Caloptenoid forms.

A Scale-insect on Maple, hitherto unobserved by American Entomologists.—Miss Emily A. Smith of Peoria, Ill., has in the April number of the *N. A. Entomologist*, an extended article on *Pseudococcus aceris*, a scale-insect that does considerable damage to maples. She deserves much credit for her careful and indefatigable studies of this and other scale insects. The paper has, however, many unpleasant errors, most of them of a typographical nature, for which the authoress is evidently not to blame. She describes, under the name of *Acerophagus coccois*, a parasite on the scale insect.

We quote what she says of the *Coccid's* habits, with a few corrections of her own making:

When first hatched the young larvæ remain upon the leaf and beside the unhatched eggs of the remainder of the egg-mass, and thrusting their slender setæ into the leaf, they commence drawing the sap which sustains their life. There is no uniformity with reference to the position assumed by the newly-hatched insect, neither is there a choice shown for any part of the leaf, whether beside a vein or midway. They remain on the lower side of the leaf, and do not settle on the upper side even temporarily. When first hatched there is no appreciable difference between the larvæ, they are all of the same bright yellow color before described, but soon after, a white substance issues from the body and gives the insects a powdered appearance. Shortly after, red and yellow ones are found. The insects which become red are the males, and are of the same length and width as the yellow ones, and the appendages are similar, with the exception of the antennæ, which have seven joints instead of six. The white coating appears upon these as well as on the yellow ones or females. When the number of insects upon a leaf becomes greater than it can furnish food for, those first hatched pass down the petiole to the stem in search of some uninhabited leaf. After fifteen or twenty days the insects have increased their size two-fold, the body has accumulated a quantity of food globules, *i. e.* adipose tissue, until its thickness has also increased, and the two setæ are coiled spirally on each side of the head. There is nothing by which a molt can be determined at this time, yet the general appearance of the insect is changed. This is more particularly true of the female larvæ. The spines upon the integument have become stronger, and from each segment at the side from three to five strong spines project, while the hairs, except from about the head and anus, are more rare.

*   *   *   *   *

Soon after birth, the sex of *Pseudococcus aceris* can be determined by the difference in color; the females retaining the yellow color throughout their entire existence, while the males as decidedly retain the red color. They change but slightly in structure, and the number of articles in the antennæ remain the same. They soon become

restless and wander aimlessly about over leaf and limb, and are met by the young females, who partake also of their restlessness, and together they wander about over the trunk and the limbs of the tree for from seven to ten days, when the females return to the leaves, and the males secrete themselves underneath the roughened outside bark of the tree and undergo their transformation into the imago. A limited number of them return to the leaves and change thereon. From the spines and pores of the integument of the body issues a white substance in which the larva is enveloped. This covering soon assumes an oval form, and is composed of threads, the inner coat cemented closely together, while the outer threads are irregularly arranged, although the form is retained perfectly. The entire cocoon is held in place by attached threads to the bark or leaf. Inside of the cocoon the larva gradually changes from the wingless insect to the mature or winged state, the rostrum disappears and two wings form. The transformation is gradual, the pupa is of a solid red color and measures from 9 to 10 millimeters long and 8 to 4 wide. The antennæ, eyes, and legs change their form, and, after about fifteen days one end of the cocoon opens and the perfect male comes out; the opening through which it emerges is circular and covers the entire end of the cocoon.

MISTAKES MADE BY INSTINCT.—Errors in instinct through the laying, or mis-laying, of their eggs by insects at wrong times or in wrong places were well known to the older entomologists, as the following interesting passage from Degeer abundantly proves. I quote from the German translation of Götze (Abhandlungen zur Geschichte, etc., vol. ii, part 2, p. 241, pl. 35, figs. 12 and 13). He has been describing a Saw-fly which spins a double cocoon. Inside one of these double cocoons, with its head sticking out of its own coarctate pupa-case, he found a dead, dipterous parasite of the Saw-fly; and he ascribes its death to a mistake of the parent fly in laying her egg on the false caterpillar of the Saw-fly when the latter was too far advanced in its growth. "Its fate," he says, "was a consequence of the mother's oversight, which seems to have laid her egg too late on the false caterpillar, so that the larva proceeding from it could not attain to its full size before the Saw-fly caterpillar must prepare for its transformation, and consequently, unwittingly let itself be shut up in an everlasting prison. It had indeed, gone on to devour the caterpillar. It had changed to a nymph within the red cocoon; but when it became a fly it could not make its way through the double cocoon of the Saw-fly, and must consequently perish. Thus the mother fly had erred in laying her egg, a thing that is not usual among insects, which on every occasion, and especially in the propagation of their species, display always so much diligence and foresight." To this, however, the translator adds in a note: "Nevertheless, examples and instances occur in more than one species, that insects, whether in respect of time or place, are frequently wont to err in oviposition. I could wish that people would collect and compare more examples of the like kind. Perhaps we might thereby discover many a secret in the economy of insects that still remains hidden from us."—J. A. Osborne, M. D., Milford, Letterkenny, in *Science Gossip*.

HOW FLIGHT IN INSECTS IS DIRECTED.—At a late meeting of the French Academy of Sciences, Mr. Jousset de Bellesme discussed the organs which direct the flight of insects. Insects in general, he contends, cannot change the angle under which they vibrate the wings, because the motory muscles of the wings are inserted within that piece of the thorax which supports these organs. Thus the wings of insects are simply motory organs, and the direction of the flight must be due to the function of other organs. Mr. Jousset is led by experiment to believe that the direction of the flight is principally determined by the displacement of the centre of gravity. In *Coleoptera* this displacement results from the position of the elytra, which therefore are the true directive organs; in *Diptera* the halteres supply this function; in the Grasshoppers the displacement of the centre of gravity depends on the inclination and "redressement" of the greatly developed hind legs; in *Hymenoptera* the abdomen modifies the direction of the flight, and in some cases the hind legs assist therein, Only in *Lepidoptera* and *Neuroptera Odonata* the changing in the direction of the flight depends largely on the wings themselves, though the abdomen appears, here also, to take part of the function.

Entomological Legislation, with respect to the locust plague in the West, like the German insect laws ("Abraupgesetze") has been to a considerable extent beneficial, though it is often difficult to enforce the execution of such laws. There are strong reasons why we should have a set of insect laws for all the States. They would be as beneficial and as easily enforced as "the game laws," and those prohibiting the harboring of certain noxious plants or of nuisances against which Boards of Health are organized. Only by some such arrangement can farmers be compelled to coöperate for their own interests and successfully combat the thieves which are robbing them of their produce, for there are plenty whose sense of obligation can only be aroused through government influence. Who will be the first to move in this project and see its execution?—W. S. B.

Entomological Work at the Department of Agriculture.—The appropriation of $5,000 to the Department of Agriculture for field work and experiment in the Entomological Division, which appropriation we inaugurated two years ago to add efficiency to that Division, was continued by the late Congress. We understand that Prof. Comstock will vigorously prosecute the present year the special study of insects affecting the Orange. He is now in California making observations on the pests of the orchard generally, but especially on those of the Orange. The subject is one of great interest and importance to orange cultivators, and special attention to it cannot fail to produce beneficial results.

Effect of Frost on Grubs.—An idea being prevalent that "cold kills the grubs," I took the opportunity whilst the great cold lasted of examining the state of all larvæ and pupæ I could find fully exposed to its influence, whether unsheltered, under bark, or in frozen ground, and found that in all cases, even where the earth was frozen so hard that the mass had to be broken up with a hammer, and the larvæ or pupæ were perfectly rigid, that on thawing they did not appear to be in any way injured; and in the case of the larvæ of the Cabbage Weevil (which was the only instance in which any immediate action was to be expected), they continued the operation of making their earth-cases for pupation (as is usual with this grub on disturbance from the gall) as if nothing had happened. In other respects, the extreme severity of the winter was favorable to insect preservation, as large numbers were secured from bird attack under the snow or in the frost-bound ground; and also the excessive cold caused an almost unprecedented mortality amongst the birds; this was especially noted amongst the *Turdidæ* and Starlings. The cold and wet spring subsequently retarded the nesting season, and further diminished the ordinary amount by the great numbers of eggs that were addled. The general returns do not show that any kind of injurious insect has been lessened in amount by the winter cold, excepting, possibly, the Turnip fly. This has been little prevalent, but, conjecturally, this is rather owing to the failure of the Turnip crops than direct weather influence, as noted in the return: "No Turnips, therefore no fly."—Miss Ormerod in Reports on Injurious Insects (England).

Destroying Codling Moth.—Prof. A. J. Cook, thus closes a recapitulation in the New York *Tribune* of the facts already published regarding this insect:

> The Michigan Pomological Society, with characteristic enterprise, has offered two prizes of $50 and $25, to be awarded to the society or neighborhood that shall work the most wisely and efficiently in destroying these insects the coming season. Cellars and other buildings where apples have been stored the past autumn and winter should be closed against all egress of the moths during May and June. Fine wire gauze at the windows will accomplish this and still afford ventilation.
>
> It is claimed by Mr. J. S. Woodward and others, of western New York, that an application of Paris green or London purple, mixed with water, at the rate of one pound of the poison to 100 gallons of water, is sure destruction to these insects, if applied the last of May. The apples are then small, with the blossom end up, and, it is claimed that enough of the poison lodges on and about the calyx to kill the newly-hatched "worm," as it begins its tunnel. I know nothing personally of this remedy, and

only mention it that others with myself may try its efficacy the coming season. The pomologists of Sagatuck, in our State, claim that they have found a remedy in sour milk, which attracts and captures the moths. It is very desirable to find a remedy which shall lure the moths or newly-hatched larvæ to destruction, as the band remedy only captures the enemy after he has done much mischief, though, when generally practiced, this soon overcomes the evil.

ENTOMOLOGICAL PAPERS READ BEFORE THE A. A. A. S.—A temporary subsection of Entomology was formed during the recent meeting of the A. A. A. S. We shall soon publish some of the papers read at the meeting, whether before the general section B or before the subsection. They are comprised in the following list, all but the first four having been read in subsection :

1. Further Notes on the Pollination of Yucca and on Pronuba and Prodoxus.—C. V. RILEY.
2. Two new methods of fighting injurious insects.—A. J. COOK.
3. Additional notes on the Army Worm (*Leucania unipuncta* Haw).—C. V. RILEY.
4. Some recent practical results of the Cotton Worm inquiry by the U. S. Entomological Commission.—C. V. RILEY.
5. Method of preparing and mounting wings of microlepidoptera.—C. H. FERNALD.
6. The contributions of the Cambridge Entomological Club to the progress of entomology.—B. PICKMAN MANN.
7. The hitherto unknown life-habits of two genera of Bee-flies (Bombyliidæ).—C. V. RILEY.
8. Remarks on the oviposition of three species of Tree-crickets.—C. V. RILEY.
9. Remarks on the early stages of Blepharocera, hitherto unknown in the U. S.—C.V. RILEY.
10. On biological collections of inscts.—H. A. HAGEN.
11. The occurrence of Aletia argillacea in Wisconsin.—P. R. HOY.
12. The migrations of the Rocky Mountain Locust.—A. S. PACKARD, JR.
13. On some very rare insect deformities.—H. A. HAGEN.
14. Insects form Copal.—D. S. MARTIN.
15. Some points in the anatomy of the Coccidæ.—E. L. MARK.
16. Structure and development of certain Hymenopterous galls.—H. F. BASSETT.
17. Notes on North American Galeodes (Solpugidæ).—J. D. PUTNAM.
18. Contributions of apiculture to science.—A. J. COOK.
19. Address of the President of the Entomological Club of A. A. A. S.—S. H. SCUDDER.
20. The honey ants of the Garden of the Gods, Colorado.—H. C. MCCOOK.
21. On Phoxopteris angulifasciana.—C. H. FERNALD.
22. List of Coleoptera hatched from a few hickory twigs.—J. L. LECONTE.
23. On the anatomy of Prodoxus decipiens.—H. A. HAGEN.
24. On the structure of the mouth organs in the Lepidoptera.—E. BURGESS.
25. An essay on lightning bugs.—J. L. LE CONTE.
26. On the Hessian fly.—H. A. HAGEN.
27. On the classification of the Tortricidæ.—C. H. FERNALD.
28. Generic characters in the Noctuidæ.—A. R. GROTE.

ENTOMOLOGISTS AT BOSTON.—As we go to press the American Association for the Advancement of Science is in session at the Institute of Technology, Boston, Mass. Former meetings have, perhaps, excelled this one in the high character and value of the papers read, but none have ever approached it, either in attendance, in the cordiality and hospitality everywhere manifest, or in perfection of arrangements, whether to facilitate work or enhance enjoyment. We congratulate the local committee, among whom none seemed more active or efficient than the retiring President of the Entomological Club of the Association, whose address we publish in this number. There were just about 1,000 persons in attendance and 600 new members elected, and as, by virtue of their various public and private entomological collections and libraries, Boston and Cambridge afford extraordinary attractions to our "brethren of the net;" these were, we are glad to record, out in full force. Such annual reunions of friends and coworkers, while conducive to the advancement of our favorite science, have a yet higher social value, and we all regretted the enforced absence (from accident) of the genial editor of our contemporary, the *Canadian Entomologist.*

The meeting of the Entomological Club on the 24th was very largely attended, and the following officers for the ensuing year elected : *President*, Jno. G. Morris, of Baltimore, Md.; *Vice-President*, C. V. Riley, of Washington, D. C.; *Secretary*, B. Pickman Mann, of Cambridge, Mass.

FRENCH AID IN STUDYING GRAPE PHYLLOXERA.—The sums placed at the disposal of the French Minister of Agriculture and Commerce for the purpose of encouraging research and experiments as to the best way of dealing with the phylloxera,

amounted, in 1879, to 500,000 francs, and this will be increased during the present year by supplementary grants to 969,750 f. Of this amount 200,000 f. are devoted to the treatment of diseased vines in the districts specified by the superior commission, while 250,000 f. will be given to doubling the grants voted by the various departmental and municipal bodies. Societies and companies formed for the investigation of the disease will also be assisted by bonuses to the aggregate amount of 300,000 f. A further sum of 100,000 f. is set aside towards encouraging the propagation of American vine stocks and the distribution of new plants and cuttings from the Agricultural School at Montpellier. Rewards to the amount of 100,000 f. will be given for furthering microscopic researches, while 50,000 f. are left for dealing with individual cases.—*Nature.*

We still omit all book notices, having been at our desk but a single week during the past two months.

EXTRACTS FROM CORRESPONDENCE.

Winged Phylloxera in California.—To-day I send you 6 specimens of winged Phylloxera which have hatched from a recent lot of infected roots from Sonoma Valley. Although I got a large lot the last time, yet I have only found 7 specimens, of which I send you the 6. I send you these lest the others sent before may not reach you in good order. We are anxious to learn whether any of these are of the fertile kind. I think I will go again to Sonoma Valley (25 miles) and get another lot of roots. The first lot I took from vines that had begun to perish; but I took the last from vines that were apparently strong and not affected, but on examination I found more insects on them than on the others. As you look at the vines where the insects are working, you see, first the dead vines, next those that have shoots six or eight inches long, then in the next row they may be one to two feet long, and in one or two more rows you cannot see any signs of their work: yet I found the most insects on those just in advance of the decaying vines. In some places the insects spread from different centres in the same vineyard. It strikes me that they are often carried by the plow and cultivator as they pass through both infected and healthy vines in cultivating. When the soil is deep and rich, they advance only about 50 to 75 feet in a year where I examined them. On light, poor soil they spread more like a fire. If there happens to be a spot of rich ground in the midst of the poor, the vines are good, although on the outskirts the insects are numerous and steadily advancing each year.

From what I have seen in Sonoma Valley, I come to this conclusion: that if the vines were utterly destroyed as soon as they were known to be infested, and also one or two rows outside of those, so as to make sure of cutting away *healthy tissue*, as a surgeon would in removing a cancer, and then avoid passing from the infested to the healthy portion in cultivating, then the progress of the insect would be very slow on rich soil in this State. If I find anything of interest in my next lot of infected roots, I will send them to you. Could you send me the best history of what is known of this insect, or tell me where I can get it?—J. S. Hyde, Fountain Grove, Santa Rosa, Cal., Aug., 6th, 1880.

[It will be remembered by the readers of the AMERICAN ENTOMOLOGIST that from the slow spread of the grape Phylloxera in the Sonoma Valley, and from the fact that no winged females had so far been detected there, Prof. E. W. Hilgard had been led to conclude that the climate of California had possibly produced such modification in the insect's charactaristics, that the winged female was not produced, and that the sexual individuals were habitually produced from wingless hypogean females, as they were known to be exceptionally in Europe and east of the Rocky Mountains—in other words that the exception in other countries became the rule on the Pacific (See AMERICAN ENTOMOLOGIST, III, p. 3). The discovery of the winged female by Mr. Hyde dissipates this rather hopeful delusion. We notice from recent communications by Prof. Hilgard to the *Pacific Rural Press*, that he still hopes that the more rapid spread of the insect by the winged female may not take place there, having decided that the specimens so far found are "sterile." We quote:

The insect is the winged phylloxera, of course, But all of the five insects sent are of the sterile variety, which is produced occasionally elsewhere, and was first believed to be the male insect. If the presumption raised by this fact should turn out to be generally true, the slow progress made by the pest in California would be completely explained. For, of course, the sterile-winged form would be more capable of carrying the infection to a distance than if, as I have heretofore conjectured, the winged form were not produced at all.

Your discovery is most important, and it now becomes more especially interesting to collect as many specimens as possible, and examine them as to their form. In the fertile, egg-laying form, the body is about half as long as the whole insect, wings included, and the abdomen is of a tapering, rounded shape. In the sterile the body is barely one-third the length of the whole, and the abdomen is so short as to form almost the two sides of a triangle. There is, therefore, little difficulty in distinguishing the two forms, and the distinction is of vital importance to the grape-growing interest in the State.—*Pac. Rur. Press*, Aug. 7, 1880.

IN the report of my remarks on the winged phylloxera found by Dr. Hyde, in your last is-

sue, I am made to say that, of the eight winged insects sent me by Dr. Hyde, five are of the infertile kind. This would seem to imply that the other three were fertile. As a matter of fact Dr. Hyde *sent me five* out of the eight found by him, and, as I learn since, forwarded the other three to Mr. Riley, from whom we may expect a report as to their character. So far we do not know with certainty that *any* fertile-winged insects are produced in California; albeit in a late letter Dr. Hyde says that he thinks he has found some of the latter kind, which he has also forwarded to Prof. Riley.—Ibid, Aug. 14, 1880.

Unfortunately four of the specimens received by us from Mr. Hyde are normal, with eggs fully developed and ready to be laid; the other two are what Prof. Hilgard characterizes as "sterile." These abnormal individuals are, however, genuine females, and so far from being sterile, they may, from aught we know to the contrary, be more dangerous than the other—the greater length of wing and undeveloped condition of the eggs at the time the wings are acquired, indicating a longer lease of winged existence, and greater migratory power. It is still highly probable, however, that this aërial, migrating form of the insect is more scarce in California than elsewhere, though its existence is now fully established.

The phenomona described in Mr. Hyde's communication are characteristic of Phylloxera spread in all countries, and especially in Europe, and his suggestions identical with those which the facts forced upon the French authorities early in the history of the invasion in that country.

We refer Mr. Hyde to our Missouri reports, (4–8 inclusive,) and especially to the 6th, in reply to his last question. We have not the reports to dispose of, but they are advertised for sale by Mr. E. P. Austin, of Boston, Mass.

Later: Since the above was in type, a later communication from Prof. Hilgard shows that he, also, has found the "fertile" winged form among subsequent specimens sent him.]

Locusts in the Northwest.—I arrived here last night, and have been looking round to-day under the guidance of Mr. Taylor. But from all I can learn here I am satisfied that there are no locusts in this country, unless they are west of Fort Ellice. The officers of the Hudson Bay Co. say they hear of none west this year.

At Glyndon I was informed by the landlord that a few locusts had been seen there flying northeast; this is the only place in the northwest that I have heard of them flying. Search at this point (Glyndon) and at the various stations northward, until near St. Vincent, revealed an occasional specimen of *C. spretus* at nearly every point, but from St. Vincent northward I failed to find a single specimen. Those found showed no signs of having migrated.

In order to learn what I could in reference to the eastern limits of their migration, I went north through Wisconsin and passed across Lake Superior to the north shore at Prince Arthur's Landing and Fort William, and then went down to Bayfield and Ashland, and closing the round at Duluth. Although locusts have been quite abundant at times on Kuwena Point, yet at no place around the lake has the migrating species been seen. One strange fact learned, that appears to be well authenticated is, that the Colorado potato beetle has been known at Bayfield for 35 (thirty-five) years. You probably remember that *La Point* on the island opposite Bayfield was settled by Marquette more than 100 years ago. I could hear nothing in reference to swarms driven into Lake Superior.— Cyrus Thomas, Winnepeg, Manitoba, July 20, 1880.

Notes on Harvesting Ants in New Jersey.—The Rev. Mr. Morris has sent you an account of a little harvesting ant which he found in Vineland, toward the latter part of June. He pointed out the interesting little creature to me, when I immediately commenced the study of its habits, which I leave for him to describe.

But I now find another harvesting ant, which I at first mistook for Mr. Morris's ant. About the 1st of July I noticed several ants with much larger heads than we had heretofore observed, going in and out of the formicary of this little ant. There was much excitement in the colony, which I supposed was caused by the invasion of great numbers of one of our most tiny species,—the little red ant which housekeepers so dread. These large-headed fellows, as well as the big-heads of Mr. Morris' ant, acted like soldiers; they were both crushing this tiny species with their strong mandibles and throwing them down, but immense numbers of the little red ant were often more than they could cope with, for these clung to the antennæ and legs of the soldiers so as to impede their progress. During the battle a good many of the largest soldiers lost their heads under very trying circumstances. They would be tumbling about, trying to rid themselves of the little ant, when Mr. Morris's soldiers would come up, as I then supposed to help them, but I noticed the big heads of the impeded soldiers were almost always severed, which I thought a very strange proceeding.

On the 5th of July I sent some of the big-headed soldiers, and their severed heads, to Dr. Forel as Mr. Morris' ant. And now on the 10th of July, Mr. Morris called my attention to this ant, telling me he thought it another species which he had found a day or two before, but I still persisted in my belief that they were only a larger form of the first ant (like the two sized large-heads in the harvesting ant in Florida), which I believed up to the morning of the 12th inst., when I found a quiet colony within the enclosure of my "insect

menagerie," where I have been closely observing ever since. I now not only think it a distinct species, but perhaps belonging to a different genus from the one Mr. Morris first called my attention to.

The colony in my "insect menagerie" are now harvesting the seeds of the wild pepper-grass (*Lepidium virginicum*). They start in line from the formicary, and keep so until they reach a little patch of ground covered with plants of the pepper-grass, the seeds of which are now ripe and fallen to the ground. On reaching this spot, the line diverges, and the little workers scatter over a space of several feet, but they all come to a certain point and return in a straight line toward home, each carrying a bright orange-colored seed, which it stores away, and starts for another.

This species has a regular dumping ground, where it throws all the refuse material—every ant going to the same spot to throw the chaff and shells of seeds.

I have never seen any of the soldiers of this species carrying seeds, but they perform other offices; they remove large pebbles, impossible for the little workers to move. And when the winged ants depart from the colony, the soldiers escort them to the entrance, frequently assisting them out.

Last evening, July 15th, many winged ants (♀ ♂) left the colony, and this morning the entrance through which they came was closed with a little hillock of pebbles.

Like the harvesting ant of Florida, *Pogonomyrmex crudelis*, most of the soldiers have no teeth on the mandibles, while the little workers are armed with teeth.

I am now observing the various species of *Aphænogaster*. The largest species which occurs here is *Aphænogaster treati*. This species occasionally carries seeds and flowers, but I think it can hardly be called a true harvester.

Since the above was written, Mr. Morris has called, and says he found the largest species *first*, but confounded the two for some time as I did. So he has the right of priority with both of these ants.

As I had both species of these ants put up to send you before Mr. Morris called (and told me he had already sent them), I will send them all the same.—Mary Treat, Vineland, N. J., July 16.

Butterflies in Iowa.—Last season I secured one specimen each of *Callidryas sennæ* and *Terias mexicana*, both of which I believe very rare in this locality. *Pieris rapæ* was taken here for the first time, and will no doubt be abundant the present season. A hundred miles east of here (Linn Co.) it did much damage last summer. Has been in the eastern part of the State still longer.—Herbert Osborn, Ames, Iowa.

Flights of Danais archippus *Fabr.*—I have noticed large flights of this butterfly twice within the past seven years. Both occurred in the Fall, September or October; in both instances there was a disposition manifested to cluster together on neighboring leaves and twigs of oak-trees; the females outnumber the males quite noticeably; when disturbed they were disposed to return to the same or nearly the same place; although they did not cling to one another like bees swarming, they were so neighborly that it was easy to take a dozen with a single sweep of the net.—O. S. Westcott, Racine, Wis.

Phylloxera Galls—Inconstancy in their appearance.—Let me mention to you one remarkable observation. The Phylloxera is changing with regard to the varieties and even species of grapes on which it prefers to produce its galls! Last year they were mostly on Nortons and Cynthianas, which they were supposed not to inhabit theretofore, and on which we only found traces of abortive galls or attempts to make galls in former years. This year they are yet rather scarce with us, but certainly *none* to be found on Clinton, none on Taylor and its seedlings (Nash, Elvira, etc.), while some of *Arnold's Hybrids* (of the supposed Northern [or Canada] Cordifolia) and the *Delaware* show them more than ever before!—Isidor Bush, Bushberg, Mo., June 10, 1880. Barnes 1880 a

Periodical Cicada in Geauga Co., Ohio.—*Septemdecim* has been quite abundant in small areas of Western Ohio, but they are now nearly all gone.—Harley Barnes, Mulberry Corners, O., Aug. 3, 1880.

Squirrels eating Gall-fly (Cynipid) Larvæ.—In reading Mr. Henry's experience as to squirrel feeding on Poplar-stem Gall-lice, I am reminded that I saw, during the summer, this same squirrel eating Cynips larvæ from an oak gall. The little fellows would seize a gall, tear it open and eat the rather large larva, and drop the gall. I saw them do this several times, and it interested me because I had supposed squirrels were confined entirely to a *vegetable diet*. The galls occur on *Quercus tinctoria*, and are *Cynips q. spongifica* O. S. You may be interested in this confirmation.—Irwin F. Smith, Agr. College, Lansing, Mich.

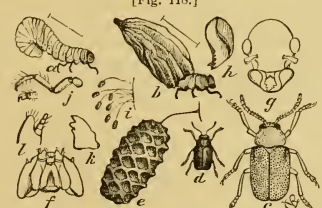
Flies riding on a Tumble-dung.—This morning, I noticed a lone beetle trundling the ordinary ball of manure. He seemed to be mottled with dingy white spots; but when he (or she) got a fall, the white spots vanished. When they began to reappear, I stooped and saw that they consisted of the gauzy wings of some black-bodied insects, which were taking a ride. Time pressed. The insects were very active.—J. T. Moulton, Jr., Farmington, Mo., May 26.

Parthenogenesis in Orgyia antiqua.—Curiously and without exception every cocoon I have examined since the middle of January—at least fifty specimens—had the mass of eggs upon it, indicating some remarkable things: 1, that it has no enemies to destroy it; 2, that it is perfectly fitted to withstand our climate; 3, that all of the winter-brood are females, and must reproduce, without the co-operation of a male, by *parthenogenesis*, which has already been discovered in some wingless insects. The eggs hatched (May 15th, 1880) as soon as the leaves were expanded, yielding the vernal brood, to which must belong the males described by others.—W. S. B.

[It is possible, also, that the males, always issuing before winter and having no occasion for permanent attachment like the females, form their cocoons on or among the leaves, which subsequently drop to the ground.—Ed.]

Dominican Case-bearer.—Last season I bred *Coscinoptera dominicana* from the eggs, and confirmed your observations on it. Two which I had hibernating under a stone came forth as adults from their cases a few days since. They

[Fig. 118.]



COSCINOPTERA DOMINICANA: *a*, larva extracted from case; *b*, do, with case; *c*, beetle showing punctures; *d*, same, nat. size; *e*, egg; *f*, head of larva, underside; *g*, head of male beetle; *h*, jaw of same; *i*, eggs, nat. size; *j*, leg of larva; *k*, jaw of same; *l*, maxilla of same. (After Riley.)

are very voracious, eating the margins off from a label in the bottle with them, and, what seems contrary to their vegetarian nature, they have devoured a small black caterpillar (probably *Lithosia miniata* Kirby) which I placed with them. —W. S. B.

Notes on Cotton Worm in Florida.—I devoted the entire day to examining McGrady's cotton fields. I have before reported in regard to this plantation that last year's crop was nearly destroyed by "the worm," which made its appearance about the middle of September after a severe easterly storm. The wind blew at first from northeast, then east, and finally southeast. This year cotton is planted in two fields, a small one adjoining and a large one on the other side of a small lake or pond about 300 yards distant. Cotton is growing still between the corn, and has been all winter. There has been no frost at all this winter. I have given a great deal of time to the examination of this field, and have searched nearly every individual cotton plant now growing in it. There is no trace of Aletia, although last March the dead chrysalides were not uncommon on the old stalks of the season before. The young cotton of this year is, some of it, 2 to 3 feet high and coming into bloom. It appears to be remarkably free from insects of all kinds. There are a few Aphis, and a red mite (specimens of which I have mounted in balsam) is found upon some plants, but is doing hardly any damage as yet. I have not yet finished the examination of the largest field. I learn to day from Mr. McGrady that "the worm" is eating cotton (long staple) in the western part of Putnam Co.—H. G. Hubbard, Crescent City, Fla., May 24th.

Army Worm in Queens Co., New-York.—I send with this mail a sample of the Army Worm, so called by our farmers. It is doing vast damage to our crops: corn, wheat, and Timothy grass. It made its presence first known June 4, in wheat fields, and does not seem to be any less in numbers.—John S. Hicks, Roslyn, N. Y., June 10, 1880.

The Clover Root Borer has taken all the clover in portions of Genesee County. I examined clover in half a dozen fields to-day, during a ride of ten miles, and found *every* plant I pulled up was more or less injured. While most of the plants are yet alive, they are of little value for hay, seed, or pasture.—W. A. Henry, Ithaca, N. Y., July 6, 1880.

Hair-worms and Red-mites Remarkably Abundant upon Locusts in California.—Since reading my brother's articles last week (being absent myself last Fall and winter), I am reminded of having seen about one-fourth of an acre of my meadow thickly filled last Fall with locust eggs, in the pools and along the creek, as the snow went off, covered with millions and millions of what I now think may have been *Gordius* (white hair snakes), about one inch long; also, another quarter of an acre fairly covered with little red mites, which hereafter I will observe more closely.

The red mite I know nothing about personally, except as found on the locust last summer; but the white grubs [Fig. 37 of the First Report of the U. S. Entomological Commission] ate out and destroyed thousands of the eggs last Fall, but, to all appearance, have eaten nothing since, having lain dormant all winter, and being now found still among the eggs which are fast hatching out. The season being favorable for a great growth, we expect about half a crop of grass, which is our principal crop.—W. C. Lemmon, Sierra Valley, Cal., June 13th, 1880. Barnes 1880b

Seventeen Year Cicada in Ohio.—I mail you to-day a few apple twigs containing eggs of *Cicada septemdecim*. I think the eggs were deposited about four or five days before. The Cicadas appeared here about May 2d, and were all gone July 1st. They have done some damage to fruit

and ornamental trees, by laying their eggs in the twigs, but nothing very serious. Among forest trees, oak and chestnut are their favorites. I have found no egg cells at a greater distance from the end of the twig than twenty inches, and most of them within twelve inches. The *Cicadas* appeared only in certain small sections, where they had been before, and do not seem to travel much, except when carried by the wind. As to their 17-year appearance, I can give you any reasonable testimony from old settlers here that it is no fable; many remember 1863 as the "Locust-year," when they were very plenty. A few also are positive in the statement that 1846 was marked by a similar appearance. I shall be pleased to furnish you any other information you may wish, if in my power.—Harley Barnes, Mulberry Corners, Geauga Co., O., July 15.

"Stink Bush" as an Insecticide.—Should the Cotton Worms make their appearance this season in large numbers, I am quite sure that I shall succeed in presenting a "destroyer," and am very anxious to make the experiment when the larvæ appear. I shall use a decoction of the leaves of what is known as "Stink Bush," which grows abundantly in our swamps. I have seen it used, and have used it myself, to kill vermin (lice) on animals, cows, horses, and hogs, and it never failed to prove itself an absolute success. I would like to have it tested thoroughly. I have well-founded hopes of its success.

I am sorry that I am unable to present the scientific name of this shrub, that you might judge of its merits. It is an evergreen, from one-and-a-half to six feet high, has a very offensive smell, and nothing touches it as food, not even insects; and it constitutes the principal undergrowth upon our creek and some of our river bottoms in South Mississippi, so far as I have been able to learn and see. Should you desire to experiment with the same, notify me, and I will send you some of the leaves.—S. B. Mullen, Harrisville, Miss., July 30, 1880.

[We shall be pleased to receive leaves and fruit of the shrub for determination, and Prof. Jones, of Oxford, will experiment with it for us. —Ed.]

Cotton Worm in Texas.—I returned yesterday from a visit of a few days to some of the Brazos Bottom plantations, fifty to sixty miles away, where the cotton worm was reported. In the immediate neighborhood of their first appearance there are several large plantations, but I found the most of those entirely exempt, and only one that had been partially affected.

On the west side of the Brazos river, at one point, there was on one small plantation the largest exhibit of the worms, which were said to be of the second progeny. The first appearance that was observed in that section was about the last days of June, on a small plantation on the east bank of the river; but were promptly poisoned, and but little, if any, injury sustained.

In all the sections where showery weather has prevailed along the coast line, cotton has attained a most extraordinary growth; but the rapid shedding of the forms is doing more serious injury than the worms, where poisons are promptly resorted to.—William J. Jones, Virginia Point, Texas, July 22d.

Ailanthus Obnoxious to Insects.—Some years since, when a caterpillar was stripping the oaks in front of my yard, I observed that some, which had ascended an Ailanthus tree (frequently called "the tree of Heaven"), fell from it paralyzed, and soon died. So, when the caterpillars attempted to cross my fence, I placed in their way, at short intervals, branches of Ailanthus leaves, and killed immense numbers of them, effectually protecting my yard and garden. I have to suggest the expediency of trying this native poison, so abundant and easily accessible, on the Cotton Worm. I have found the common larkspur an effective poison on insects. Would it not answer as well for the Cotton Worm?—P. H. Skipwith, Oxford, Miss., July 24.

Phora aletiæ Not a True Parasite.—In examining my breeding jars and boxes, I invariably find a species of *Phora* present in them, whenever they contain any dead animal matter. This is, so far as I can make out, the *Phora aletiæ* which Prof. Comstock considers one of the parasites of Aletia. Mr. Trelease gives his experience with this fly exactly as I should myself, from my own observations. He does not consider it a true parasite, but yields the point to Prof. Comstock. Evidence is daily accumulating in my notes of the purely scavenger habits of the *Phora*. To-day I watched them pass through the meshes of fine muslin gauze, covering my breeding jars, in which moths have died, or pupæ been killed by dampness and mold. They (the flies) gather about moldy food and excrement of larvæ, but do not deposit eggs unless they find dead moths, larvæ, or pupæ, and moisture. The flies are very persistent in pushing through crevices, and I watched with interest the gravid ♀♀ try to squeeze through the gauze. Sooner or later, after many trials, a ♀ finds a mesh that is loose, and gets through. I see that they have often widened the meshes, and pass and re-pass through.—H. G. Hubbard, Centreville, Leon Co., Fla., Aug. 6th.

[This *Phora* was obtained by us on several occasions from Aletia chrysalids, in 1879, and quite commonly by Mr. Schwarz; but we never considered it truly parasitic, and doubt whether it ever is strictly so.—Ed.]

Harvesting Ants in New Jersey.—Permit me through your columns to announce the discovery of a Harvesting Ant, hitherto unknown. My attention was first called to it in June, by little piles of the husks of seed. I have examined several formicaries, and found some cells filled with various kinds of seed in good preservation. The worker is about a line long. The soldier is much larger, and has an immense head, marked with striæ visible only under mi-

croscope. The male and female are of great size, in comparison with the workers. In my artificial formicaries the big-headed soldiers work vigorously, and so do the winged queens.—G. K. Morris, Vineland, N. J., June 10, 1880.

P. S.—July 15.—Further study has demonstrated the fact that I discovered two species of harvesters on the same day, though the specific differences escaped my notice for a few days. I send you the larger one. The other is from a half to one third the size of this. Mrs. Treat thinks it may even belong to a different genus, but in this she doubtless errs.—G. K. M.

ANSWERS TO CORRESPONDENTS.

[We hope to make this one of the most interesting and instructive departments of the ENTOMOLOGIST. All inquiries about insects, injurious or otherwise, should be accompanied by specimens, the more the better. Such specimens, if dead, should be packed in some soft material, as cotton or wool, and inclosed in some stout tin or wooden box. They will come by mail for one cent per ounce. INSECTS SHOULD NEVER BE ENCLOSED LOOSE IN THE LETTER.

Whenever possible, larvæ (*i. e.*, grubs, caterpillars, maggots, etc.) should be packed alive, in some tight tin box—the tighter the better, as air-holes are not needed—along with a supply of their appropriate food sufficient to last them on their journey; otherwise they generally die on the road and shrivel up. If dead when sent, they should be packed in cotton moistened with alcohol. Send as full an account as possible of the habits of the insect respecting which you desire information; for example, what plant or plants it infests; whether it destroys the leaves, the buds, the twigs, or the stem; how long it has been known to you; what amount of damage it has done, etc. Such particulars are often not only of high scientific interest but of great practical importance.]

Worm infesting Meal Sacks.—Will you please give me the name of the inclosed larvæ. They were found within the folds of a sack used to hold oats, corn and meal, and "shorts," and on the outside of the sack. Each larva was covered with a silk-like covering, which was attached to the sack by a broad surface.—James Greenwood, Jr., West Boylston, Mass.

The pale worms with rows of minute spots of a more dusky color, each giving rise to a hair, and with a brownish-yellow head and cervical shield are the larvæ of *Ephestia zeæ*. This is a little moth which Dr. Fitch called the Indian-meal moth and of which he gave a figure in his Second Report as State Entomologist of New York (1857). It is characterized by the basal third of the wings being of a pale cream color, while the outer two-thirds are of a more obscure reddish-gray. This worm is almost omnivorous and feeds with equal relish on all sorts of dried animal and vegetable substances, being, however, particularly fond of grains and fruits. We have found it quite injurious to old English walnuts and pecans, the larva always eating out at the suture at the base of the nut before spinning its cocoon. It is likewise to be found in cinnamon bark, while if it once gets in a cabinet of insects it does much injury by feeding upon the mounted specimens. It also injures old books that are not often handled. It cannot of course multiply in grain or meal that is kept well protected and fresh, or in sacks that are in constant use.

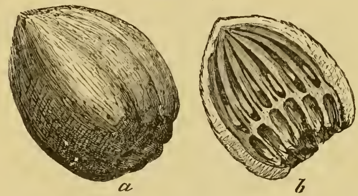
Hesperid Larva Feeding on Canna.—I send you by the same mail as this, a moth, the larva of which was taken from a Canna leaf. Please inform me in regard to it.—N. S. Reed, Chandlerville, Ill., July 10.

The insect is a large-bodied butterfly, belonging to the family of Skippers (Hesperidæ), and is known to science as *Pamphila ethlius* Cram. The same species was sent to us some time ago from South Carolina, where the larva utterly destroyed some luxuriant plants of *Canna flaccida*.

Grape-vine Apple-gall.—I send in paper box, by this mail, a gall found on summer wild grape-vine, also a green beetle, from Pigeon Mountain, in this county; also a gall from Ives Seedling, with smaller leaf attached.—A. R. McCutchen, Lafayette, Walker Co., Ga.

The green, succulent excrescences on the petioles of grape leaves, the one (from Ives Seed-

[Fig. 119.]



GRAPE-VINE APPLE-GALL: *a*, whole and detached from vine; *b*. do, cut open and showing cells and larvæ—nat. size (after Riley).

ling) looking like a tomato, the other (from wild grape-vine), more like an apple, are the grape-vine apple-gall (*C. vitis-pomum* W. and R., Fig. 119), and are caused by a species of gall-gnat, probably of the genus *Cecidomyia*. The green beetle you enclose is the Rummaging Calosoma (*Calosoma scrutator* Fabr.) It is a very beneficial insect, as it feeds upon caterpillars and other injurious insects.

Apple-tree Plant-lice in Oregon.—Enclosed you will find a small limb, taken from an apple-tree that is covered with a kind of louse, that will absolutely destroy our apple and pear trees. They propagate themselves on the plum, cherry, ash, and willow, also; but not so extensively as on the apple and pear. Will send the terminus of a limb of this year's growth, to show you how fatal they are to anything they touch. There are millions, yes, billions; they fill the air many times.

Please tell me their name, and give a remedy. I have given no descriptions. I think that you can see them in all their stages of life in the sample. Hoping to hear from you soon, I remain yours.—H. B. May, Oregon City, Or., July 12.

The apple leaf you send proves to be badly infested with a species of Plant-lice, apparently *Aphis mali*. But, as the insects were all dead and dried up when received, it is impossible to positively determine the species. A good remedy for these plant-lice is to thoroughly syringe the infested trees with strong soap suds. This rem-

edy should be applied early in spring, before the plant-lice have become too numerous.

Phylloxera Work.—Wood-lice on Grape-vine Roots.—I herewith send you a small box, containing some insects, which we suppose to be Phylloxera. This spring we found that the vines in one of our hot-houses, containing grape-vines two years old, made an effort to start finely, but dwindled away. There was no apparent cause for it, but, on examining the roots, we found these insects destroying all the fibrous roots—just sucking the life out of them. Mr. Carey, who has the management of my place, uncovered the inside border and deluged it with tobacco-water, which must have destroyed millions of them. By the time the weather admitted uncovering the outside border, the fibrous roots were all destroyed, and the larger roots knotted and black. Shortly after, the *American Agriculturist* for May came to hand, and then we saw what we had to contend with. Never having had anything of the kind before, we did not know what these insects were. We had everything hauled away—vines, root and branch, boards, drainage, *everything*—hoping thereby to save an older house, but to no purpose. This last was an old, established house. During the past fifteen years thousands of pounds of as fine hot-house grapes as I ever saw have been cut from it. Until this spring the borders have been such a mass of healthy, fibrous roots, that they could not be forked over. The men had to spade them over as best they could. Now, not a fiber is to be seen, and the great, thick old roots are a blackened mass. In this house the Gall-louse has also made its appearance this season.

The article on the Phylloxera referred to, is an exact description of our case, as if it had been written for that purpose.

Some of our grape-growing neighbors, who are threatened with the same trouble, are trying to think it is not Phylloxera. For their sakes we hope it is not. Will you please decide the question, and very much oblige?—Hettie B. Trimble, West Chester, Pa.

The smaller rootlets of grape-vine you send show the work of Phylloxera, but not to a serious extent. The large swelling on the roots, however, cannot possibly be the work of Phylloxera; but whether or not it is caused by the little Crustacean, which was very numerous in the creases of the swelling, we have no means of ascertaining. Dr. A. S. Packard, Jr., to whom we submitted specimens, thinks that they are the young of some species of *Phyloscia*, or *Porcellio*, and says that he never heard of their being injurious to plants.

Descriptive Department.

NEW HICKORY GALLS MADE BY PHYLLOXERA.

BY C. V. RILEY.

Phylloxera caryæ-scissa, n. sp.—Gall, a flattened, smooth, green swelling on the leaf of *Carya alba*, very similar both above and below, usually confluent, circular, and varying from 4^{mm} to 9^{mm} in diameter, opening in a transverse slit on the under side of leaf; the lips with a white pubescence, though the inside of the gall is smooth.

The gall in June is crowded with Phylloxeræ of all ages, from the newly hatched young to the winged female—a fact which indicates that the females have been breeding within the gall, as there is no stem-mother noticeable. The eggs are very small and translucent, and must hatch very rapidly.

Phylloxera caryæ-avellana, n. sp.—Gall, looking somewhat like a filbert, on the under side of the leaf of Carya, being perfectly smooth and flush with the upper side of the leaf, forming above a broad, somewhat circular, pale-yellowish spot, either flush with the surface of the leaf, or slightly depressed. The surface of the gall is slightly sticky, and in this respect and in the mode of opening recalls *P. caryæ-gummosa*. It may at once be distinguished from that, however, by being sessile.

In June crowded with the insects mostly in the pupa state, or already winged, though many young are also to be found, the young being quite pale and colorless, and the yellow color becoming more distinct with age.

Both these galls were sent by Mr. William H. Ashmead, of Jacksonville, Fla., and in them was found the same orange Dipterous larva (*Diplosis*) so often found preying on similar gall-lice further North.

TWO NEW BEES OF THE GENUS SPHECODES.

BY W. H. PATTON, WATERBURY, CONN.

Sphecodes arvenis.—♀. Mandibles armed with a tooth, as usual. Vertex not tuberculate. Disk of thorax shining. Abdomen strongly punctured; red, the tip black.

♂. Entirely black, Antennæ submoniliform.

Agrees in size with *S. dichroa*, Sm.; but differs from that species in the male being entirely black, and in the female having the tip of the abdomen black.

Very common in the Eastern and Middle Atlantic States.

Sphecodes falcifer.—♀. Mandibles unarmed; labrum deeply emarginate. Vertex not tuberculate. Thorax opaque. Segments 1—4 of the abdomen red.

♂. Entirely black.

May be distinguished from *S. confertus* Say, by the 4th segment of the abdomen being red in the female. Agrees in size with the preceding species. The form of the mandibles and labrum separate the female from all other species known to me.

Common in New England.

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THE FOOD OF THE BLUEBIRD (Sialia sialis, L.).

BY PROF. S. A. FORBES, NORMAL, ILL.

[*Concluded from p.* 218.]

JULY.

The nine birds of this month were all shot in central Illinois, during four successive years. Besides the return of the percentages of Hymenoptera, Coleoptera, Lepidoptera and Arachnida to about their usual figure, we notice the large ratios of June-beetles (12 per cent.) and Orthoptera (27 per cent.). The latter includes 7 per cent. of *Udeopsylla nigra*, a large cricket-like locust. We find also a trace of raspberries in the food of two individuals. The caterpillars eaten by these birds were unrecognizable, except those from a single stomach, which Prof. Riley has identified as *Nephelodes violans*, Guen. The record of benefit and injury is now more favorable to the species—67 per cent. of injurious insects, and only 14 per cent. beneficial,—the latter *Carabidæ* and spiders.

SEPTEMBER.

No birds have yet been studied for August, and but two for the following month. Nearly the whole food of these two birds was composed of moths, caterpillars and grasshoppers. The number is too small to signify much, and this month has been omitted in calculating the averages for the year.

DECEMBER.

To learn the food of the Bluebird in midwinter, I went to extreme Southern Illinois in December, 1879, and shot a number of specimens, some from the heavy forests in the bottoms of the Ohio river, and others from the wooded and cultivated highlands in Pulaski county. The weather at this time was sometimes above and sometimes below freezing, and bluebirds were abundant and very much at home. The principal food of the twelve specimens examined consisted chiefly of various wild fruits, (84 per cent.) of which the berries of the mistletoe (*Phoradendron flavescens*) were the most abundant (58 per cent). Grapes, the berries of sumach, scarlet thorn, (*Cratægus*) and holly (*Ilex decidua*) were also found. Sixteen per cent. of the food was insects, of which the larger part (10 per cent.) was the larvæ of *Harpalinæ*,—eaten, however, by but two of the birds. Prominent among these was the larva figured and described by Prof. Riley in the Report of the U. S. Entomological Commission for 1877, p. 290, and there doubtfully referred to *Harpalus herbivagus*. The remaining kinds were *Geotrupes blackburnii*, *Podisus spinosus*, a single spider, and one unknown caterpillar. Even in the dead of winter, therefore, this bird does not cease its warfare on our predaceous bugs and beetles.

SUMMARY FOR THE YEAR.

To these figures, giving the averages for

all the months mentioned taken together (except September), I invite especial attention. Being derived from a much larger number of specimens than any of the monthly averages, they are much less likely to be affected by accident or error. They give, furthermore, the basis for an estimate of the total effect of the bird, year after year; and from this we should be able to predict the probable effect of a destruction or diminution of the species.

Taking up first the injurious insects destroyed, we find that these include 24 per cent. of Lepidoptera, nearly two-thirds of which were recognized as *Noctuidæ*, 3 per cent. of leaf-chafers, 1 per cent. of curculios and 12 per cent. of Orthoptera,—chiefly grasshoppers,—a total of 40 per cent. on this side of the account. On the other hand the ichneumons amount to 4 per cent., the *Carabidæ* to 9 per cent., soldier beetles to 2 per cent., soldier bugs to 3 per cent., and spiders to 9 per cent.—a total of 27 per cent. of predaceous and parasitic forms. Other elements are, ants 4 per cent., *Diptera* only a trace, *Aphodii* 7 per cent., *Tenebrionidæ* 1 per cent., *Iulidæ* 2 per cent. and vegetable food 15 per cent. The edible fruits amount to about only 1 per cent. of the food of these 86 specimens.

Comparing with the *Turdidæ*, we find that the Bluebird is essentially a thrush in food. From the robin it differs principally in the larger number of Hymenoptera (8 to 1), and Lepidoptera (24 to 18), the lack of Diptera (robin 18 per cent.), the excess of *Aphodii* (7 to 2), of *Cydnidæ* (robin only a trace), of Orthoptera (12 to 5), and of spiders (9 to a fraction); but especially in the matter of edible fruits (1 to 28). These differences are but little greater, however, than those among the thrushes themselves. Compared with the thrush family as a whole, its salient peculiarities are its neglect of Diptera and garden fruits, and its preference for cutworms, grasshoppers, *Cydnidæ* and spiders.

What now shall we say of the economical relations of this bird? According to the estimate of Mr. Walsh, previously cited, the Bluebird does at least twenty times as much harm as good,—that is to say, the beneficial insects destroyed would themselves have made away with twenty times as many injurious insects as the birds themselves have eaten. Admitting that Mr. Walsh's estimate was exaggerated, it surely was not twenty times too large; and, even if it were, we could merely look upon the Bluebird as harmless, indeed, but as useless also.

And yet, in the face of this, I venture to doubt that a case has yet been made out.

In the first place, nothing has been learned of the food of the young; and there is some reason for supposing that birds select for their young the softer kinds of insects. This supposition, founded chiefly upon the statements of M. Florent-Prevost, of Paris, is contradicted, it is true, by observations of the food of the young mocking-bird;* and whatever deficiency of credit may be due to this neglect of the food of the young is compensated in part, at least, by the fact that the number of caterpillars eaten is doubtless over-estimated, in comparison with hard insects, as their flexible skins remain in the stomachs of birds longer than the hard structures of insects. This is exactly contrary to the usual supposition; but the frequent occurrence of numbers of the emptied and twisted skins of cutworms in the stomach, still recognizable as *Noctuidæ*, when not even a fragment of a single head remains, is sufficient evidence that the hard parts break up and disappear before these delicate but yielding skins.

Secondly, while our knowledge of the food of Arctians, cutworms and grasshoppers is sufficiently definite and full to enable us to predict with certainty exactly what would happen if those eaten by bluebirds were allowed to live and multiply, we have not the same complete and certain knowledge of the food and habits of the different genera of *Ichneumonidæ*, the ground beetles, the soldier bugs and soldier beetles.

One hundred bluebirds, at thirty insects

* Trans. Ill. State Hortic. Soc., Vol. xiii., p. 128, footnote.

each a day, would eat in six months about half a million insects. If this number of birds were destroyed, the result would be the preservation, on the area supervised by them, of about 170,000 caterpillars, (90,000 of them cutworms), 20,000 leaf-chafers, 10,000 curculios and 85,000 crickets, locusts and grasshoppers. How this frightful horde of marauders would busy itself if left undisturbed, no one can doubt. It would eat grass and clover and corn and cabbage, inflicting an immense injury itself, and leaving a progeny which would multiply that injury indefinitely. On the other hand, would the 200,000 predaceous beetles and bugs, spiders and ichneumons either prevent or compensate these injuries? I do not believe that we can say positively whether they would or not.

In a discussion of the natural checks upon the cutworm, Prof. Riley, in his first report as State Entomologist of Missouri, mentions two species of *Ichneumon* that parasitize the larva, credits the Spined soldier bug and the carabid larva, *Calosoma calidum*, with its destruction, and says that some kinds of spiders are known to prey upon it.

From the report of the U. S. Entomological Commission for 1877, we learn that the grasshopper is preyed upon at one or the other stage by *Agonoderus*, *Harpalus*, *Amara* and other Carabids; by soldier beetles, soldier bugs and spiders; and that certain *Ichneumonidæ* parasitize the egg. It seems *probable*, therefore, that the beneficial insects eaten by bluebirds include the special enemies of the cutworms and grasshoppers it destroys; but he who knows best the small number of reliable observations upon which our general statements of the food of predaceous insects rest, will have the most hesitation in trusting them without reserve. The *probabilities* seem to be against the Bluebird, but the *certainties* are, as yet, in its favor.

Finally, I would call attention to the fact that we do not yet know that the normal rate of increase among these carnivorous and parasitic insects is not sufficient to keep their numbers full to the limit of their food supply, and to furnish also a *surplus* for destruction by birds. Just as a tree puts forth more leaves than it needs, and sets more fruit than it can possibly mature, as an offset to the constant, normal depredations of insects, so there is much reason to suppose that our insect friends have become adjusted to this steady drain on their numbers. There are many considerations involved here which I cannot at present enter into. It will suffice to say that all the evidence we have of the increase and decrease of carnivorous insects attendant upon the increase and decrease of the insects upon which they feed, tends to show that the real limit to their multiplication is not destruction by birds, but a deficient food-supply; and that in relieving them from their feathered enemies we should only be giving a portion of them the poor privilege of starving to death instead of being eaten up.

Considering, therefore, the certainty of the evil consequences of the destruction of the Bluebird, and the uncertainty of the possible good, I believe that, notwithstanding the apparent balance against the species, even the most radical economist, the most indifferent to the beauty and pleasure of the natural world, would have no present justification for throttling the song of the Bluebird in his garden with the hope of increasing thereby his annual store of hay and cabbage.

SUMMARY.

A recapitulation of the above data can best be given in the form of the appended table. The digits indicate the number of birds in which each element of the food was found,—the decimals show the ratio of that element to the entire food of all the birds for the month. The general average and total for each element appear at the right of the table, and the general averages of benefit and injury for the 86 birds will be found at the lower right-hand corner. They differ by a unit from the figures given in the text, because the fruits are included in the table, but ignored in the discussions.

Summary of the Food of the Bluebird.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Ratio of each element to whole of Food.
No. of Specimens Examined.		10	21	13	9	10	9		2			12	86	
KINDS OF FOOD.	Number of Specimens and Ratios in which each Element of Food was found.													
I.—Insecta		10 .92	21 .88	13 .88	9 .76	9 .71	10 .89					5 .16	77	.75
1. *Hymenoptera*		7 .22	5 .04	5 .02	3 .02	7 .21	6 .04						33	.08
Formicidæ			2 —	5 .02	3 .02	6 .20	6 .04						22	.04
Ichneumonidæ		6 .22	2 .04										8	.04
2. *Lepidoptera*		8 .28	20 .38	9 .21	7 .39	5 .13	7 27					1 .02	5	.24
Arctiinæ		1 .02	4 .04										5	.01
Noctuidæ		6 .24	11 .29	5 .17	3 .19		1 .10						26	.14
Phalænidæ						2 .06							2	.01
3. *Diptera*		1 —	1 .01	1 —		1 —							4	
4. *Coleoptera*		9 .22	16 .19	13 .51	8 .18	7 .28	10 .26					4 .13	67	.25
Carabidæ		6 .05	16 .10	10 .08	5 .12	3 .06	4 .09					2 .10	46	.09
Dytiscidæ						1 .01							1	
Staphylinidæ				1 —									1	
Histeridæ			1 —	1 —									2	
Byrrhidæ				1 .01									1	
Scarabæidæ		3 .09	4 .04	10 .33	2 .05	5 .12	3 .14					1 .03	28	.11
Aphodius		3 .09	2 .03	10 .31	1 .03	4 .04							20	.07
Geotrupes												1 .03	1	
Phyllophaga				1 .02	1 .02	1 .08	2 .12						5	.03
Euryomia			1 .01										1	
Elateridæ			1 —			1 .01							1	
Tenebrionidæ				1 .04									1	.01
Telephorus		3 .08	2 .04										5	.02
Curculionidæ		1 —	1 —	3 .01	2 .01	1 .01	3 .01						11	.01
Cerambycidæ						1 .01	1 .02						1	
Tetraopes						1 .01	1 .02						1	
5. *Hemiptera*		4 .07	10 04	7 .04	2 .02	3 05	2 .05					1 .11	29	.04
Coriscus			4 —	1 .01									5	
Alydus							1 .04						1	.01
Cydnidæ		3 .07	7 .04	4 .02	2 .02	3 .05	1 .01					1 .01	21	.03
6. *Orthoptera*		7 .13	13 .21	5 .08	6 .13	2 .03	5 .27						38	.12
Locustidæ							1 .07						1	.01
Gryllidæ		1 .04	2 .03		1 .02		1 .01						4	.01
Acrididæ		6 .09	11 .18	5 .08	5 .11	2 .03	5 .19						34	.10
II.—Arachnida		6 .04	16 .05	9 .09	6 .21	5 .18	2 .05					1 —	45	.09
III.—Iulidæ		6 .04	8 .03	2 .01	1 .01		2 .02						19	.02
IV.—Vegetable Food			3 .04	4 .02	3 .02	5 .11	6 .04					12 .84	33	.15
Percentages for each Month. Beneficial Elements		.46	.28	.21	.35	.38*	.14					.11	**.28**	Totals for the Species.
Injurious "		.41	.60	.23	.55	.26	.67					.02	**.39**	
Neutral "		.13	.12	.56	.10	.34	.19					.87	**.33**	

* Includes 8 per cent. fruit.

NEW PLUME MOTHS (Pterophoridæ).

BY MARY E. MURTFELDT, KIRKWOOD, MO.

The pretty and characteristic group of Plume Moths have, as yet, received but little attention at the hands of American entomologists. The late Dr. Fitch described a few species, while Prof. Riley, Dr. Packard and Mr. Chambers have each published descriptions of one or two, and this is the extent, as far as the writer is informed, of the work done in this country. European entomologists have, meanwhile, through their collectors in various localities, secured and named a large proportion of our species, many of which have been described by Prof. Zeller of Stettin, Prussia, and by Lord Walsingham of England.

Some two years since, Mr. Charles Fish, of Old Town, Me., selected this interesting family of insects for a specialty, and has collected and studied with so much assiduity as to make himself already our best authority on the subject. He has expressed his intention of shortly publishing a revision of our indigenous species, and endeavoring to clear up, as far as possible, the confusion of synonymy at present existing. Such a work is much needed, and will, together with Mr. Chambers' publications on the *Tineina*, and Prof. Fernald's forthcoming *List of American Tortricidæ*, give our Microlepidoptera a definite place in entomological literature.

The distribution of the *Pterophoridæ* in this country is quite variable. But few species are found in the Atlantic States and the Mississippi Valley, while California and the Pacific slope generally, as I am informed by Mr. Fish, is comparatively rich in species. In the course of seven or eight years' careful collecting, I have only obtained from this locality (vicinity of St. Louis, Mo.) nine species, viz.: *Pterophorus carduidactylus* Riley; *Oxyptylus* (*Pterophorus*) *periscelidactylus* Fitch; *O. tenuidactylus* Fitch; (*O. nigrociliatus* Zeller); *Platyptilia Bischoffii* Zeller; *Œdematophorus inquinatus* Zeller; *Leioptilus paleaceus* Zeller; and an undetermined *Alucita*, of which I have taken but a single specimen, which is, according to Mr. Fish, the only representative of the genus as yet reported in North America. In addition to these, I have bred the two following species, the first of which is common, the second quite rare.

My acknowledgments are here due to Mr. Fish, for generic determinations, and much other highly appreciated aid in this field of study.

THE SILKY-WINGED PLUME, *Leioptilus sericidactylus*, n. sp.

This species closely resembles Zeller's *L. paleaceus*, but differs from it in its darker general color and distinctly striped abdomen:

Larva: Length, 0.55 inch; diameter, 0.10 inch; form sub-cylindrical. Color, when young, dingy-white, with a tinge of green, becoming at maturity pale glaucous, often varying, especially in the late Fall brood, to dull salmon. Dorsal hairs proceeding from prominent tubercles, and of two sizes in each tuft, each of the shorter ones tipped with a minute pellucid bead of viscid fluid, to which pollen and bits of leaves often adhere. Lateral ridge well defined. Prolegs long and narrow. When mature, the larva weaves a dense mat of silk, upon which it extends itself, remaining quiescent for two or three days, the dorsal surface acquiring, meanwhile, a translucent lilaceous hue, with three greenish-white longitudinal stripes, of which the medio-dorsal is most distinct and continuous.

Pupa, with ventral surface closely appressed to the mat of silk, to which the anal hooks are firmly attached. An upright or inverted horizontal position seems to be preferred, although there is no thoracic band or other support for the anterior part of the body.

Average length 0.45; diameter same as larva, tapering rather abruptly from seventh abdominal segment backward. Wing sheaths narrow, free at the blunt-tips. Dorsum with prominent sub-dorsal ridges. Color and markings quite variable. In the spring brood commonly dull green, with indistinct yellow lateral stripes. In the Fall brood the dorsum is pale yellow, or flesh color, with two fine indistinct medio-dorsal lines of lilac color; sub-dorsal ridge pale, inclining to lilac on outer side. In sub-dorsal space are two nearly continuous, quite heavy, black or fuscous lines, separated by a broad, pale stripe, from two narrow, interrupted, dark lines, one beneath, the other, above stigmata. On the thorax the dark stripes are represented by two slightly diverging dashes on each side. Situated in the sub-dorsal ridge, at the posterior edge of each segment, are a pair of small, geminate piliferous warts, each bearing a sparse tuft of light sprangling hairs. The last larval skin, rolled into a little hairy ball, is often supported over the back of the chrysalis, raised above it on the hairs of the sub-dorsal ridges. The pupa is quite active and irritable, striking about in all directions when meddled with.

Imago: Length of body averaging 0.45; diam-

eter of abdomen, when fresh, about 0.09; that of the male narrowly fusiform—of the female cylindrical. Alar expanse, 0.80. The primaries cleft one-third of the distance from outer margin to base. Secondaries trifid, first cleft extending two-thirds from outer edge to base; second cleft from margin to base. Color of primaries ashy-buff, somewhat variable in shade, with a brownish hue toward the tips. At the angle of the fissure is a small, but distinct round, black, or fuscous spot.

Secondaries yellowish drab color, with a peculiar silken lustre and texture. Ciliæ concolorous with general surface. Under surfaces of both primaries and secondaries lustrous ashy-brown.

Thorax cream-white in some specimens, with three faint longitudinal stripes of pale brown.

Face, back of head and neck pale brown, apex cream-white. Palpi short and sub-cylindrical, with an obscure notch near the tip—buff, with outer border fuscous, especially at tips. Antennæ with very short pubescence, of a buff color, faintly annulated with pale brown. Eyes varying from olive-green to dull black. Fore and middle legs cream-white, with fuscous shadings on under side. Tibiæ of fore legs thickened at lower end. Hind legs cream-white, tibiæ cylindrical, first pair of spurs slightly unequal. Abdomen distinctly striped with fine, dull-brown, longitudinal lines on cream-white ground.

This species breeds on the Iron weed (*Vernonia noveboracensis*). It is double-brooded; the spring brood feeding on the tender terminal leaves, while the autumn brood feeds almost exclusively on the flowers. The larva spins no web until ready to change; nor does it roll the leaves, or bore into the flowers; but may be found extended openly on the surface of the leaves or flowers. The eggs are deposited singly. They are spherical, of a greenish white color, and about 0.02 in diameter, with a smooth, glossy surface.

THE MINOR AMBROSIA PLUME—*Œdematophorus ambrosiae*, n. sp.

Larva: Length, 0.35; diameter, 0.09. Form depressed. Color pale greenish gray, with very characteristic dark markings and lateral tufts of long, white, silken hairs. Head small, light brown, corneous, retractile. Segment 1 with a dilated, partially free, shield-like collar covering top and projecting over the head. The ornamentation of this collar consists of five central minute brown dots, with four still smaller black ones on each side, from each of which proceeds a short, curved bristle. The projecting edges are fringed with soft, light hairs. Segments 2 and 3, gradually broadening backward, ornamented on dorsum with two oblong, pale-brown spots on either side of a triangle of very minute black dots, and having a larger black dot on each outer side. Two short bristles arise from each of the more conspicuous spots. Abdominal segments, each with four, somewhat elevated, brown spots, from which proceed single, short, backward-curving bristles. Between the posterior pair of brown spots are two smaller black ones, each of which forms the base of a very short clubbed piliferous process, which turns backward, resting flat upon the surface.

The stigmata are annulated with black, and obliquely above and forward of each are two small brown dots. The lateral tufts are below the stigmata, and each is composed of from seven to nine long hairs, which, under the lens, are remotely pectinate. A little above and back of each of these tufts is a semicircle of fine, scale-like bristles. The prolegs are very short.

Pupa: Length, 0.25. Swollen and blunt anteriorly. Color pale fulvous, with a roseate hue on dorsum. Dorsal surface beset with tufts of dingy hairs, with a lateral fringe of single straight hairs, which serve to secure it more firmly to the mat of silk upon which it rests. Dorsum marked, near the head, with two large dull-brown spots, and an indistinct longitudinal stripe of same color on the abdomen. On either side of the thorax is a small, velvety dark brown dot.

Imago: Length, 0.33; alar expanse, 0.55. Ground color of primaries pale ochreous-cinereous, with an irregular intermixture of fuscous scales. On the costa of the outer third are two distinct dark-brown longitudinal marks, with a less strictly defined one at the angle of the fissure. Apex darkly shaded, the dark brown color predominating in the ciliæ of the lower edge of the superior division. Secondaries lustrous cinereous, with faint purplish reflections. Upper fissure extending two-thirds from apex to base; lower fissure from outer edge to base. Face, neck and palpi tawny, the latter small, cylindrical. Antennæ cinereous, obscurely ciliated with brown. Eyes dull olive-brown. Thorax dingy cream-white. Anterior and middle legs cinereous, with fuscous shadings; tibiæ slightly enlarged at lower ends, spurs prominent. Posterior legs cream color, with brown spots at the juncture of the spurs; tarsal joints also annulated with brown. Spurs nearly equal, darker beneath. Abdomen cylindrical, or slightly fusiform; joints fringed at posterior edges with elavate scales.

This pretty little species is rather rare in the vicinity of St. Louis; but more abundant further South.

It feeds on the Rag-weed (*Ambrosia artemisiæfolia*), and I have only found it late in the season.

I have distinguished it as the "*Minor* Ambrosia Plume," because Zeller's *inquinatus*—a somewhat larger, though very similar species—feeds on the same plant.

THE COLEOPTEROUS PARASITES OF THE COMMON HICKORY (Carya tomentosa).

BY JOHN L. LECONTE, M. D.*

During the past two years some hickory trees on the country-seat of a friend, situated near Philadelphia, became diseased to such an extent that they were cut down

* Read before the Entomological Club of the A. A. A. S.

and converted into fire-wood. Finding them both in trunk and twig much perforated by the burrows of insects, he kindly sent me some small bundles of twigs and branches of ½ inch diameter and less, which I placed in boxes, and occasionally moistened.

Most of the Coleoptera mentioned in the subjoined list were hatched from these twigs, but I have added to those developed in my library the names of some others previously known to me as infesting the same tree; these are marked with an asterisk.

The size of this list, numbering 24 species, several of which are rarely found by collectors, and two of which are still undescribed, indicates the large addition to our knowledge of forest pests which may be made by very simple means.

My object in publishing it is to excite some interest among students to pursue this easy method of adding to their collections, and, at the same time, of furnishing information which will soon be of use. I am also not without hope that the Commission employed by the Government to devise means for protecting the forestry of the country may be induced to furnish to scientific men not thus employed, specimens which may lead to the identification of the tree parasites. Such identification of species is, of course, a pre-requisite for the devising of rational means for repressing the injuries done by these insects.

I addressed the Club briefly on this subject last year, and I am glad that what I then said has been supplemented by some practical instructions from Mr. C. G. Siewers,* Newport, Ky., indicating convenient methods of making these observations.

Though I have not yet received any lists of species thus obtained from our forest trees, and but few specimens for determination, I cannot believe that in a country so eminently given to 'practical' pursuits, the importance of this subject will continue to remain unrecognized. I hope that by the time the Commission on Forestry, appended to the Department of Agriculture, is ready to make a final report, some competent person, albeit not receiving government recognition in an official capacity, may be prepared voluntarily to furnish a list of forest insect-pests.

* Canadian Entomologist, 1880, 138.

Without such an appendix, any report made by that Commission will be conspicuously imperfect; the list should contain the names of at least the most easily collected and most destructive parasites of each one of our valuable forest trees, with the time of appearance, and the length of period of evolution.

LIST OF SPECIES.

Lyctus striatus.*
Anthaxia viridifrons, April 10th.
Agrilus egenus, April 21st.
———, probably n. sp., April 8th.
Phyllobænus dislocatus.
Chariessa pilosa, April 16th.
Sinoxylon basillare.
Heterachthes quadrimaculatus.
Phyton pallidum, May 20th.
Molorchus bimaculatus.
Cyllene picta.*
Neoclytus erythrocephalus.
Tillomorpha geminata.
Acanthoderes quadrigibbus.
Liopus cinereus, April 24th.
Ecyrus dasycerus, April 21st.
Saperda discoidea.
Oncideres cingulatus.
Dysphaga tenuipes* (fide Haldeman).
Tribolium, n. sp., March.
Læmosaccus plagiatus, April and August.
Xyleborus celsus.
Thysanoës fimbricornis, April and May.
Chramesus hicoriæ, April and May.

FOOD HABITS OF THE LONGICORN BEETLES OR WOOD BORERS.

BY THE EDITOR.

Among the vast number of insects injurious to our forests, shade and fruit trees, none hold a more prominent position than the Longhorns or Longicorns (*Cerambycidæ*). The larvæ or grubs of these beetles bore into the wood of various trees, shrubs and ligneous plants, some species confining themselves to one species of tree, while others take a wider range and attack several, or work indiscriminately in all the species of a genus.

The habits of all our species will not be discovered for many years to come, but as a working basis to guide future observers, we have thought it would be well to recapitulate in the columns of the AMERICAN ENTOMOLOGIST what is already known regarding the habits of this family in North America. We will do this as briefly as possible, arranging the species in the order of their more recent classification, merely prefacing by the following explanations:

Where the habit is well known and has been repeatedly recorded and testified to we simply give the first authority where the facts are mentioned, quoting subsequent authorities only when a difference in habit is noted.

Unpublished observations are indicated by the name of the observer only.

The abbreviations are few and as follows:

Am. Ent.—American Entomologist.

Am. Nat.—American Naturalist.

Harris—A treatise on some of the insects injurious to vegetation, by Thaddeus William Harris, M. D., edited by C. L. Flint.

Prac. Ent.—Practical Entomologist.

Can. Ent.—Canadian Entomologist.

We shall be pleased to publish any further experience from the readers of the ENTOMOLOGIST that will serve to complete the summary here given, and we tender our thanks to Drs. Le Conte and Horn, Mr. Schwarz, Mr. Fuller, and others, for notes and references that have helped to complete the list.

PRIONIDÆ.

Ergates spiculatus (Lec.), bores in *Pinus ponderosa* in Colorado, (A. S. Fuller).

Mallodon dasystomus (Say), boring in Live Oak, Hackberry, Pecan, attacking trees in healthy condition and often greatly injuring them, but preferring trees which have already suffered from one or another cause. The perfect insect issuing from April till August, in Florida and Texas (E. A. Schwarz).

Mallodon melanopus (Linn.), breeds in the Box Elder (*Acer negundo*)—E. G. Mumford, Bell Co., Texas; (auctore A. S. Fuller); boring in the roots of oak shrubs at Cedar Keys, Fla., the beetle appearing in June; boring in *Celtis Texana* near Columbus, Texas (E. A. Schwarz).

Mallodon serrulatus (Lec.), boring in *Celtis texana*, Columbus, Texas, the perfect insect appearing in July (E. A. Schwarz).

Orthosoma brunneum (Forst.), "inhabits pine trees" (Harris p. 96). "The larvæ which I suppose to be this species is common under the bark of pine logs" (Fitch, 4th Rep., p. 28).

Prionus laticollis (Drury). The larvæ live in the trunks and roots of the Balm of Gilead, Lombardy Poplar, and probably in those of other kinds of poplar also (Harris, p. 96); in roots of grape vine and apple trees, (C. V. Riley, 2nd Missouri Report, pp. 87–88); in decaying oak stumps (C. V. Riley, *l.c.*, p. 91).

Prionus imbricornis (Linn.), larva infesting grape roots; feeding upon the roots of herbaceous plants (C. V. Riley, 2nd Missouri Rep., p. 89–91); in roots of pear trees (C. V. Riley).

Tragosoma Harrisii (Lec.). Fitch infers that it breeds in the Pine (8th Rep., p. 29); larva in decaying stumps of pine trees near Marquette, Mich., the perfect insect appearing at the beginning of August (E. A. Schwarz).

CERAMBYCIDÆ.

Asemum moestum (Hald.), "found in all stages under the bark of oaks early in May" (Packard, p. 496); boring in grape vine according to Dr. Shimer (Packard, ib.); bred from Scotch Pine (C. V. Riley); pupa found under bark of pine stumps near Tallahassee, Fla., in March (E. A. Schwarz).

Criocephalus nubilus (Lec.), larva boring in roots of Yellow Pine which had been laid open by a newly made ditch, Tampa, Fla.: the perfect insect appearing in April (E. A. Schwarz).

Smodicum cucujiforme (Say), larva boring under dry bark of Live Oak (Fla.), Beech (Mich.), and Hackberry (Texas) (E. A. Schwarz).

Dularius brevilineus (Say), boring in dry elm wood. "It lives in dry as well as dead elm, but usually in such trees as are partly dead" (Am. Ent., I, p. 228).

Hylotrupes bajulus (Linn.), inhabits fir, spruce and hemlock wood and lumber (Harris, p. 100); "on dying Arbor-vitæ in May in Washington, D. C. (C. V. Riley).

Hylotrupes ligneus (Fabr.), boring in sap wood of Red Cedar, Manhattan, Kan. (C. V. Riley).

Phymatodes variabilis (Linn.). "The larva of this insect may be found in early Spring, under the bark of White Oak logs and stumps" (Horn. Proc. Ent. Soc., Phil., I, p. 30); boring in the hoops of powder barrels (Am. Nat., 1879, p. 262).

Phymatodes varius (Fabr.), is found with *Callidium variabile* (Horn. Proc. Ent. Soc., Phil., I, p. 30); "is probably an oak borer, specimens having been found in the trunk of a Black Oak" (Fitch 5th Rep., p. 13); "from oak wood in all probability" (C. V. Riley).

Phymatodes amoenus (Say), boring in dead wood of Isabella and Clinton grape vines (Shimer Proc. Am. Ent., Soc. II, p. 9).

Callidium antennatum (Newm.), larvæ mostly just under bark of pines. "Just before they are about to be transformed, they bore into the solid wood to the depth of several inches" (Harris, pp. 100–101); bores in pine wood and in Red Cedar, mining under the bark (Packard, Guide, p. 496); "the larva living in the trunks of pines, excavating a wavy shallow track under the bark, which is packed full of sawdust, and when almost

fully grown, sinking itself obliquely downward several inches into the wood, to repose during its pupa state" (Fitch, 4th Rep., p. 27).

Dryobius 6-fasciatus (Say), found on the same situation as *Saperda lateralis* in the common Elm (Fitch, 5th Rep., p. 61); on Beech (C. G. Siewers).

Chion cinctus (Drury), inhabits the Hickory, in its larva state forming long galleries in the trunk of this tree in the direction of the fibres of the wood (Harris, p. 97); boring in the trunks of apple tree (Fitch, 3d Rep., p. 8); in Hickory after it is felled (Walsh Prac. Ent. pp. 30–31).

Eburia 4-geminata (Say), boring in honey-locust timber (Walsh Prac. Ent., II, p. 69).

Elaphidion atomarium (Drury), boring in dry twigs of *Quercus vircus* and in the dry leaf-stems of *Chamærops palmetto* in Florida; boring in healthy Hackberry trees in Texas (E. A. Schwarz).

Elaphidion mucronatum (Fabr.). As the preceding (Schwarz); in large limbs of wild grape vines (C. V. Riley).

Elaphidion inerme (Newm.). The perfect insect cut from dry twigs of *Quercus vireus*, Enterprise, Fla., June (E. A. Schwarz).

Elaphidion villosum (Fabr.), the well known "oak pruner." Its habits were first made public by Prof. Peck, (Mass. Agric. Repository and Journal, vol. v, 1819) and are often referred to by entomological writers. In Quercus, Carya and Castanea, also in Abies (Haldeman, Trans. Am. Phil. Soc., x. 1487, p. 34). It does not only attack Black and White Oak, but has also been observed boring in Plum and Apple twigs, and in dry grape cane (C. V. Riley).

Elaphidion parallelum (Newm.), boring in Plum twigs (Am. Ent., I, p. 187); boring in Oak, dry grape cane and Apple twigs (C. V. Riley).

Elaphidion irroratum (Fab.), boring in the trunk of the Black Mangrove, Indian River, Florida (H. G. Hubbard).

Tylonotus bimaculatus (Hald.), "found under bark of Tulip-poplar" (Bland Proc. Ent. Soc., Phil., I. 95); in Black Ash (A. S. Fuller); in Fraxinus (Haldemannn, Trans. Am. Phil. Soc., x. 38).

Callichroma splendidum (Lec.), breeds in the timber, and the beetles feed upon the flowers of "Gum elastic tree"* (W. H. Williams, Galveston Co., Texas, *teste* A. S. Fuller).

Megaderus bifasciatus (Dup.). Taken from Cedar timber in the month of December (John A. Friebele, Comal Co., Texas, *teste* A. S. Fuller).

Tragidion fulvipenne (Say), bores in oak (Am. Ent., p. 80).

Stenosphenus notatus (Oliv.). A specimen was cut from a Hickory tree in March (C. V. Riley).

Cyllene pictus (Drury), is the well known hickory borer; attacks also Pecan and Butternut (C. V. Riley).

Cyllene robiniæ (Forst.), equally well known as the Locust-tree borer.

* This name is applied to a species of *Nyssa*.

Cyllene antennatus White, "lives in the Mesquit wood," Arizona (Dr. G. H. Horn, Trans. Am. Ent. Soc., viii., p. 135).

Glycobius speciosus (Say.), the Sugar-maple borer (Harris, pp. 101–102).

Arhopalus fulminans (Fabr.), "excavating a burrow in the soft sap-wood of oak," (Fitch, 5th Rep., p. 13); bores the Red Oak, comes out in June (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller).

Xylotrechus colonus (Fabr.), "bred from oak" (C. V. Riley).

Neoclytus capræa (Say). "The larva of this species bores in the Ash" (C. Thomas, 6th Ills. Ent. Rep., p. 151); breeds in the White Ash, preferring fallen trees, coming out early in spring (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller); boring in felled Elm and Hickory trees (C. V. Riley).

Neoclytus erythrocephalus (Fabr.), raised from Hickory wood (Dr. G. H. Horn, Proc. Ent. Soc., Phil., I, p. 29); boring in dead Elm (H. G. Hubbard, Detroit, Mich., *teste* C. V. Riley); a gravid female found near the root of a rose bush in Washington, D. C. (C. V. Riley).

Cyrtophorus verrucosus (Oliv.), obtained numbers from dead quince bushes, working near the roots (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller).

Zagymnus clerinus (Lec.), bores in the dry leaf stems of *Chamærops palmetto*, in Florida, the beetles appearing in April and May (E. A. Schwarz).

Desmocerus palliatus (Forst.). "The larva live in the lower part of the stems of the Elder, and devour the pith" (Harris, p. 115).

Desmocerus auripennis, lives on the Elder of the Pacific (Dr. G. H. Horn).

Ulochætes leoninus (Lec.). "A pupa and a perfect insect found under pine bark at Fort Crook, Cal." (Dr. G. H. Horn, Proc. Ent. Soc., Phil., VI, p. 293).

Rhagium lineatum (Oliv.). "The larva live between the bark and the wood of the Pitch Pine, often in great numbers together, and, when they are about to become pupæ, each one surrounds itself with an oval ring of woody fibres, within which it undergoes its transformations. The beetle is matured before winter, but does not leave the tree until spring" (Harris p. 116).

Leptura zebra (Oliv.). "The larva and pupa inhabit the Black Oak" (Dr. G. H. Horn, Proc. Ent. Soc., Phil., I, p. 30).

(To be continued.)

REPELLING FLIES.—I manage to keep flies out of my stable by removing the droppings several times a day, and sprinkling very slightly the floor of the stable with kerosene. I have a tin can with a cork in it, through which is pierced a small hole; through this I drop the kerosene. A pint will last over a week, and seems to be quite objectionable to flies of all kinds. —Wm. Horne, V. S., in *Country Gentleman.*

TEMPERATURE AND RAINFALL AS AFFECTING THE CHINCH BUG—PERIODICITY IN ITS INCREASE.

BY PROF. CYRUS THOMAS.

While engaged in preparing my work of 1879—which related in part to the chinch bugs—for publication in the third annual report of our Commission, I concluded to make a more careful study of the meteorological conditions bearing upon their development than had been heretofore made.

This attempt has brought to light certain facts which I think will be of interest to the readers of the ENTOMOLOGIST. For the purpose of this investigation I selected Illinois and the immediately adjoining portions of Iowa and Missouri, first, because the history of the chinch bug has been more thoroughly written up for this section than any other, and second, because the meteorological records, though not complete, are fuller for this section than any other portion of the chinch bug area. Confining my investigations to this area, excluding the Cairo record as not belonging to the same limited climatic type, and rejecting the early Sandwich record as doubtful, I have combined the rainfall records of the other stations, and taken the average for each year.

Commencing with the Athens record in 1840, I have calculated the annual average up to 1877, the latest records I have at hand. Having ascertained the general average, which I find to be 38.30 inches per year, I next found the variation of each year from this average.

These variations I have represented by curves, as here shown. The temperature will also be considered, and is shown on the diagram.

The points of this graphic representation, to which I desire to call attention at present, are as follows:

First.—The fact that the series appears to be divided into cycles of seven years each. For example: if we commence with 1876, which is considerably above the average, and count back by sevens, we shall find that each seventh year was above the average, to wit: 1869, 1862, 1855, 1848, 1841. If we commence with one below the average we find the same rule holding true in most cases; thus, commencing with 1874, and counting back, we find 1867, 1860 and 1853 below the average, 1846 forming an exception. Commencing with 1842, which was below the average, we find 1849 on the average line, and 1856, 1863 and 1870 all below it.

Secondly.—A careful examination reveals the fact that this septenary period is divided into two sub-periods of four and three years.

This will be apparent if we commence with 1848 and count forward; the ternary period coming first, and the quarternary second; thus, 1851, then 1855, 1858, then 1862, 1865, then 1869, 1872, then 1876.

Thirdly.—The relation of the rainfall to the appearance of the chinch bugs. As I have argued in Bulletin No. 5, U. S. Entomological Commission, and elsewhere, and as I believe is now generally admitted, two successive dry years are necessary to the development of these insects in large and injurious numbers. According to this theory, as applied to our graphic delineation, the only years of the series represented which could have been serious chinch-bug years are the following: 1854, 1857, 1860 or 1861, 1864, 1871 and 1874 or 1875.

The chronological history of the species shows that, although appearing in intermediate years in limited localities, the great chinch-bug years in the region designated were 1850, 1854, 1871 and 1874, the northern region suffering considerably from its depredations in 1861 and 1864. In this series 1850 forms an apparent exception to the rule; but if we take the average rainfall for the first twelve years—1840--1851—we find it to be 40.97 inches, instead of 38.30 inches. The rainfall of 1849 was 38.49 inches, and 1850 but 40.69 inches, showing that the year 1850 really formed no exception to the rule. In 1862 these insects appeared in considerable numbers in some sections, but were destroyed by the wet weather; a considerable number appeared also in 1865 in northwestern Illi-

nois,—the year in which Dr. Shimer observed them dying of some disease. Each of these three years follows a preceding dry period of two or three years.

Fourthly.—According to this representation, 1878 should be below the average; 1879 above it; 1880 and 1881 dry; and the chinch bugs probably appear in 1881.

I have not yet received the records of 1878–9, but expect to examine them before the report is published. That those who have the records and desire to make the comparison may do so, I here state that for the average from 1873 to 1877 I use the Signal Service records for Chicago, Dubuque, Davenport and St. Louis, counting the year from January to December.

As I do not wish to take up too much of your space, the last point I call attention to is the fact that this exhibit shows a decrease in the amount of rainfall.

If we divide the series into sections, and take the mean or average of these divisions, the fact of a decrease becomes apparent.

Dividing into two sections the average is as follows:

1840 to 1858	——	39.58 inches.
1859 to 1877	——	36.86 "

Dividing into three sections:

1840 to 1851	——	40.97 inches.
1852 to 1864	——	36.79 "
1865 to 1877	——	37.10 "

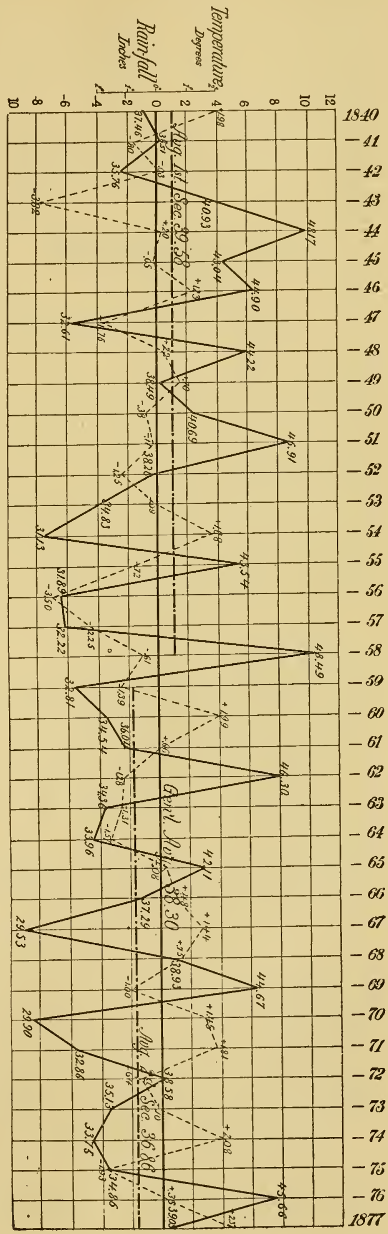
Dividing into sections of seven years:

1842 to 1848	——	41.37 inches.
1849 to 1855	——	39.12 "
1856 to 1862	——	36.04 "
1863 to 1869	——	37.26 "
1870 to 1876	——	35.82 "

Dr. Draper's examination of the rainfall in New York City, or any point on the sea-coast or larger lakes, cannot form a fair test in reference to the increase or decrease of rain precipitation. The only records by which this question can be properly tested are those of the interior of the country.

In the accompanying diagram the rainfall is given in absolute amounts and indicated by a heavy line; the temperature is given in variations from the mean (50°.

[Fig. 120.]



80) only, and is indicated by the dotted line—the small scale at the top refers to it. In the full scale at the top of the page the rainfall also is given in variations from the mean only.

The high temperature of 1854, '71 and '74, together with the diminished rainfall, furnish the key to the cause of the great development of the Chinch-bug during these years.

ADDITIONAL EXPERIMENTS WITH PYRETHRUM.

The following experiments were made at our instance by Mr. H. G. Hubbard, at Centreville, Fla., to show the effect of California Buhach (Pyrethrum) powder on young Aletia larvæ, the object being to ascertain the minimum quantity that could be used with effect.

All the larvæ were hatched last night from eggs laid in breeding jar during the night of Aug. 7th (except larva [*n*], which was only a few hours from the egg).

(*a*). Three minute fragments of *Pyrethrum* laid upon back (terminal half of body) with the point of a needle, larva affected in 15 seconds; convulsed in 1 minute and 15 seconds. Died in P. M.

(*b*). One minute fragment applied on back (anterior segments); fragment dropped off in 3 minutes; probably only adhered to hairs of body 3½ minutes; larva appeared affected but slightly; after three hours larva appears to have recovered. P. M., went to eating and fully recovered, This is a very vigorous larva, probably several hours older than the rest. (Aug. 12.; has grown larger, and eating well.)

(*c*). One almost microscopic fragment applied, with needle point, to side near spiracles; evidently affected in 15 seconds; convulsed in 1½ minutes. Fragment adhered one minute. Larva died in P. M.

(*d*). One very minute fragment (almost microscopic fragment) applied on side of body near middle. Larva lost sight of during 4 minutes, at end of which time was entirely convulsed. Died in P. M.

(*e*). Several (3 or 4) small fragments applied on side of body; affected in 30 seconds; convulsed after 2 minutes 15 seconds. Died in P. M.

(*f*). One minute fragment on middle of back; affected in 1 minute 15 seconds; convulsed in 3 minutes; fragment dropped off in 3 minutes. Four o'clock, P. M., larva recovering; later, went to eating; entirely restored. (Aug. 12, alive and well.)

(*g*). One microscopic fragment on back at anal extremity of body and very soon lost off (20 seconds?). Seemed affected after 5 minutes; examined after 2 hours, seems not injured. In P. M., entirely well [see (*g'*)].

(*h*). One large fragment (size of "blowfly" egg) applied for 5 or 6 seconds to side of body, near or upon spiracles; affected in 2 minutes; convulsed in 4 minutes; 2 hours, unable to move about; 4.30 P. M., still alive but disabled. Died before night.

(*i*). One entirely microscopic fragment applied to back of neck; affected in 1½ minutes; convulsed in 3 minutes; 4.30 P. M., appears recovering. (Aug. 12th, larva died this morning.)

(*k*). One entirely microscopic fragment applied underneath anterior segments between legs; adhered only a few seconds; appears affected after 15 minutes, but able to move about. 4.30 P. M., recovering and eating; later, fully recovered. (Aug. 12, alive and well.)

Note.—Larvæ (*l*,) (*m*,) and (*n*,) were treated as follows: A small quantity of Pyrethrum placed on a piece of paper was lightly sprayed with an atomizer, and allowed to remain covered with drops of moisture for about 10 minutes. The larvæ were then touched with a needle dipped in this poisoned dew.

(*l*). A single, very slight, and probably insufficient application beneath anterior segments; no moisture adhered to larva; affected after 1 minute 15 seconds; 1 hour later, appears torpid but not convulsed. 4 P. M., recovered and eating. (Aug. 12, alive and well.)

(*m*). Touched with poisoned dew about anterior segments, and moisture left upon the back of the segments; more thoroughly applied than in preceding larva; affected in 45 seconds; convulsed in 2 minutes. 4.30 P. M., recovered. (Aug. 12, alive and well.)

(*n*). A very young larva, probably hatched late this morning, was allowed to crawl along needle and over a drop of poisoned dew; instantly affected; convulsed in 15 seconds. Died in P. M.

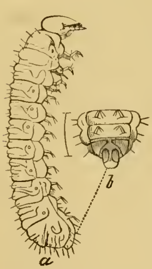
(*g'*). Second experiment with larva (*g*) made in P. M. One fragment, size of blowfly egg, laid on back, middle of body, not touching the skin, but adhering to hairs, dropped off in 30 seconds; evidently affected in 45 seconds; completely convulsed in 2 minutes. Died in a few hours.

A NEW ENEMY TO THE STRAWBERRY.

Prof. A. J. Cook, of Lansing, Mich., publishes in the Lansing *Republican*, of June 24, 1880, an interesting article read before the Ingham County Horticultural Society, giving an account of a Strawberry leaf-beetle (*Paria aterrima* Oliv.), with descriptions of the insect in the larva, pupa and imago states. This is a small, brownish leaf-beetle, which we have known to injure strawberry leaves for the past six years, having found it with this habit in southern Illinois and Missouri, and having received it in the Fall of 1874 (Oct. 5) from the esteemed horticultural

editor of the *Country Gentleman*, Mr. J. J. Thomas, of Union Springs, N. Y., with the following remarks: "The smaller [specimens] are sent from Barre, Mass., and are said to be destructive to strawberry plants, eating the leaves and doing great damage. They are said to be shy, and hide close to the plant." The larval habits and transformations of the species remained unknown, however, until Prof. Cook discovered them. From his account it appears that they do not materially differ from those of the Grapevine Colaspis (*Colaspis flavida* Say), of which we gave an account in 1870* or from that of the Striped Cucumber-beetle, which we treated of in 1867.† The insect lives in the larva state underground, feeding on the rootlets of the plant it attacks; there it transforms to pupa and perfect beetle, in which last state it continues its ravages by feeding on the leaves of the plant. The larva of the *Colaspis*, as stated by us (l. c.), feeds also on the rootlets of the Strawberry, and might, therefore, be often mistaken for the *Paria*. The former larva is anomalous in having a series of fleshy ventral projections (see Fig. 121), and as the insects are related by subfamily characters, we quote Prof. Cook's description of that of the Paria:

[Fig. 121.]



Larva of *Colaspis flavida* (after Riley).

"The larva is white, with yellowish head and brown jaws. There are eleven segments back of the head. The breathing mouths show plainly along the side of the body. There is only one pair wanting, those on the first thoracic ring. The pair on the second ring are very large. There are rows of hairs extending transversely one to each ring, but few hairs to each row on the side of each ring. About each stoma[ta] there seems to arise a tuft of hairs. The usual three pairs of thoracic jointed legs are plainly visible. The length is 5½ mm (.22 in.)"

It would seem to be easily distinguished from the Colaspis larva, therefore, by the want of the projections, though we are confident that the above quoted description would mislead, since a larva with but 11 joints, besides the head, and 8 pairs of spiracles, would upset the unity of structure in the Family and Order to which it belongs. The body will be found to consist of 12 (not 11) joints and a subjoint, besides the head, and to have the normal 9 pairs of spiracles—the first or largest pair probably in a fold between the pro and meso-thoracic joints; for when the number varies at all in Coleopterous larvæ (which is very rarely), it is by the addition rather than the reduction of a pair.

We quote the concluding portion of the article:

"In a small spherical cocoon of earth we find the pupa. It is also white, shorter than the larva, only 4 mm. in length. * * *

"The little beetle is only 3 mm. (⅛ in.) long. The head, antennæ, legs, and wingcases are yellowish, the thorax brown, and the under side of the body black. The center of the thorax is clouded with black, and generally each wing-cover is yellowish, dotted with two black spots. The posterior spot is much the larger. In about one beetle in six I found them all black. In a few cases the black beetles were tinged with yellow at the tip of the body. * * *

HABITS.

"These beetles, like all of their family, are voracious feeders, and though small, are so numerous that in early spring and after harvest they completely defoliate the strawberry plants. They have done this at Mr. Ezra Jones', and, as I understand from him, in the strawberry plantation of a Mr. Gardner of Dimondale, from whom Mr. Jones procured some plants and from whose place he thinks he brought the pest.

"The larvæ appear to eat the young, tender roots, and in this to differ from others of the leaf-eating beetles. As these larvæ as well as the pupæ are in the earth about the roots of the plants, we see that their importation with affected plants would be very easy, and could only be avoided with certainty by having the roots of the plants thoroughly washed before setting.

REMEDY.

"I feel certain that either Paris green or London purple would certainly destroy the beetles if applied to the plants as we apply them to destroy the potato beetle or canker-worm. In the use of Paris green, caution is necessary that the article may be genuine. When I hear that the potato beetle, rose chafer, etc., grow fat on this poison, I feel sure that the poison is not there, but that some spurious compound is colored and sold for Paris green."

The Cochineal insect, native to Mexico and Central America, is said to thrive well in Florida.

* 3d Mo. Ent. Report, pp. 81-84.

† 2d Mo. Ent. Report, pp. 64-66.

THE USE OF PARIS GREEN.

The *Farmers' Review* has a very interesting letter on this subject from its regular contributor, Prof. C. V. Riley, which is worthy of special attention by all horticulturists. The Professor says that few persons, have, perhaps, been more instrumental than himself in advocating the use of Paris Green and London Purple as remedies for special insects like the Colorado Potato-beetle or the Cotton Worm, and this not without pretty severe condemnation from some persons who had never had any practical experience in combating injurious insects. The tendency at the present time seems to be to recommend these arsenical compounds for almost all insect pests of the farmer and fruit-grower, and, while they may be advantageously used against a very large number of leaf-eating insects that affect, on the one hand, plants, the leaves of which are not made use of for food, or, on the other, trees used for shade, he thinks there is a limit beyond which it is unwise and unsafe to employ such poisons, or to recommend them. Mr. Riley continues:

"Prof. Cook, of the Michigan Agricultural College, has lately recommended them for the killing of a strawberry leaf-beetle (*Paria aterrima* Oliv.), which, as he shows, lives in its larva state beneath the ground; also for the destruction of the Apple Worm. In the first instance it were eminently dangerous to use such a poisonous remedy while the plants are fruiting, and I would not recommend it even later in the season, until every other available remedy had been tried. In the second case it is even less to be recommended. It will, undoubtedly, serve to kill many of the first brood of worms, and this is desirable; but there is as good evidence that lime or plaster dusted on to the young fruit has much the same effect, while experience has shown that the bandage system, and other methods of fighting this insect, when judiciously and persistently adopted from year to year, are sufficient to insure a crop at trifling cost. Finally, if the poison is so persistent in the calyx as to have any effect in destroying the second brood of worms, that will only heighten the danger to those persons who subsequently eat the fruit.

"The use of these poisons to destroy the Canker Worm on young, non-bearing orchards, or on bearing trees before the fruit is set, is quite a different thing, and attended with little, if any, risk."—*Farmers' Review.*

DESTRUCTION OF BIRDS OF PREY.

BY A. S. FULLER.

"Out of the frying-pan into the fire," is a quaint old saying that is as often applicable to the wisdom of nations as to that of individuals. Men who get one idea into their heads and start out to build some great and imposing structure with such a limited capital, or attempt to regulate some natural law which they imagine is not quite as it should be, usually find that they have made a miscalculation somewhere, and their schemes, for some unaccountable reason, do not work quite satisfactorily to themselves or anyone else. In Europe, as well as in America, the birds of prey (*Raptores*) have been generally considered as enemies of the farmer and gardener, on account of their well-known habit of catching the small insectivorous species, as well as in the case of hawks and owls destroying domestic fowls. But of late I notice that the ornithologists of Great Britain are again discussing the "Wild Birds Protection Act" very thoroughly, and they claim that it is a great mistake to exclude the "prey-catchers" and afford them no protection, and class them among the enemies of the husbandman, because the hawks, owls and other raptores not only destroy mice, moles, rats and other vermin that feed on grain, but they also catch and devour thousands of sparrows and other granivorous birds. A correspondent of *Land and Water*, in referring to this subject, says:

"The gamekeeper, in his gross ignorance, believes that hawks, in gaining their legitimate living, prefer game to other food, as though they knew of the arbitrary distinction made only by the laws of man; and this is his sole reason for

destroying them, because, perchance, they may kill a few of his young pheasants and partridges, which he is rearing only to be slaughtered by the degenerating battue system."

The above remarks are just as applicable to the farmers of this country as to the ignorant game-keepers in England; for the owls, hawks, and other birds of prey are looked upon as enemies to be shot on sight, or trapped whenever an opportunity presents. It is no wonder that the fields are overrun with mice, and hundreds of thousands of fruit trees are annually girdled and destroyed by these pests, whose natural enemies have been driven away or killed. Better keep the chickens and turkeys in a secure lath-covered yard until they are too large to be caught by hawks, than to kill off all the birds of prey.

The Crow and Blackbird, although not classed among the birds of prey by ornithologists, are considered as such by our farmers, and pursued with as much vindictiveness, because both are sometimes caught stealing a few grains of corn, and the former is known to be fond of eggs, and is not at all particular in regard to their kind, whether it be those of the duck, hen, or those of some wild bird of the field or forest. But with all their faults there can be little doubt that they do far more good than harm, in destroying many millions of noxious insects. Only give the crow half a chance and he is the best insect collector known, and there is scarcely anything of the kind that comes amiss, for he has a voracious appetite and a good digestion, and I have known a young half-fledged crow to devour a hundred rose-beetles for breakfast, without appearing to be at all uncomfortable afterward, or lose his appetite for a good dinner of the same.

INSECTICIDES NOW IN USE IN THE SOUTH FOR THE PROTECTION OF COTTON.

In some remarks at the late meeting of the A. A. A. S. I gave an account of some of the more recent practical results of the investigation now being carried on by the U. S. Entomological Commission to ascertain the best means of controlling the insects affecting the cotton plant. I herewith give you the substance of that portion referring to insecticides.

The experience of the year has, so far, given us nothing superior to the substances previously tested. We have over five tons of extracts and decoctions of various native plants centered at Selma, Ala., made either by Prof. R. W. Jones, of the University of Mississippi, or by Mr. James Roane, agents of the Commission. But two or three so far give any promise, and these not much. Yeast ferment or beer mash, which Dr. Hagen so strongly recommended, has proved entirely useless. Of the various arsenical poisons, Paris Green still proves the best so far as efficacy and harmlessness to the plant are concerned, but the use of this and of different preparations of white arsenic is to-day so well understood that they need no further mention.

LONDON PURPLE.

Of this arsenical refuse which I introduced a year ago with a good deal of hope as a cheap substitute for Paris Green, it will be well, however, to say a few words.

The testimony in regard to it is very generally favorable the present year, as I anticipated would be the case from the experiments we made a year ago. But some reports are less favorable, and such mostly come from parties who have not understood how properly to mix and use it. Pound for pound it should be made to go twice as far as Paris Green, *i. e.* a pound of the Purple is sufficient to 80 or even 100 gallons of water, and if used dry should be in proportion of 1 to 40 parts of the diluent.

It should be borne in mind that great care is necessary in mixing it in water to prevent its forming lumps, and that it acts more slowly than Paris Green. To this last fact is due most of the unfavorable experience and judgment. If a rain follow too soon after an application the Purple kills comparatively few worms. Its good effects are fully seen only under favorable circumstances on the second or third day, while the Green shows its good

effects a few hours after application and particularly the day following. In the early use of the Green the same diversified experience was had, and from defective methods or adulterated material unfavorable results were quite frequent. One source of failure with both these materials in liquid is the lack of provision to keep them stirred up and well suspended; another, in not bearing in mind that the poison has greater specific gravity than the water in which it is carried, so that in poisoning many rows at a time the finer spray falls on the furthermost rows with little or no poison.

London Purple is exceedingly fine and sifts through the slightest crevice. This is an advantage to the planter who uses it on his cotton, but necessitates great care in shipping. The manufacturers have shipped it for the most part in barrels which have permitted it to leak and stain other goods as well as the vehicles of transport, thus doing more or less injury and prejudicing freight agents against it. This defect should be remedied.

Experience seems to indicate that it is less dangerous to use than Paris Green. I know of two negroes who stole some flour in which it had been mixed in the ordinary proportion for use on cotton, and made biscuits thereof. Both were made sick but neither seriously, and Prof. Barnard found that the steward on one of the Mississippi steamboats (the decks of which get quite purple from carrying it) has made regular use of the wastage so easily obtained on every hand for coloring his pastry and ice cream. That no ill results have followed is no reason for perpetuating the practice. Some of the unfavorable experience with this Purple I am constrained to believe has resulted from adulteration.

PYRETHRUM.

This powder of which, since last year's experiments I have had great hopes, fully warrants them. No other vegetal substance approaches it. Last year, while it was found by Prof. Hilgard of California, that an alcoholic extract of any part of the plant possessed the insecticide property, I had serious doubts whether it could ever be successfully used in the cotton field because of its cost. The simple powder mixed with flour as a diluent could then be made to go over more ground than the alcoholic extract. The present year we have found that an ordinary fluid extract made after the ordinary formula of the pharmacopæa will go much farther and that the extract from a pound kills all young worms when diluted in 120 gallons of water! Nay, more, one of the most important discoveries is that it acts equally well, or even better, simply mixed in water; and even one pound to 150 gallons is effective, and one pound to 200 gallons will cause the destruction of most young worms. Its action is really marvelous; but, as it kills by contact, its effects are not lasting as in the case of arsenical poisons which act through the stomach. It produces convulsions, and paralyzes, so that all young worms it comes in contact with soon writhe to the ground. Larger worms are less easily affected, but they too writhe to the ground, from which they rarely recover, even if the Pyrethrum fails in the end to kill; for, once on the ground and enfeebled, a host of enemies are ever ready to finish the work begun by the powder. This insecticide acts quite differently on different insects, but Aletia is one of the most susceptible to it.

I have not a doubt but that when it is once produced in this country so that the cost of the powder will be nominal, it will be extensively employed by planters, and to this end I have taken steps to have it introduced and cultivated. Its harmlessness to man, the small quantity necessary, and the fact that it may be grown by the planter himself, will offset the greater permanency of the arsenical powders.

OILS.

Nothing is more deadly to the insect in all stages than kerosene, or oils of any kind, and they are the only substances with which we may hope to destroy the eggs. In this connection the difficulty of diluting

them, from the fact that they do not mix with water, has been solved by first combining them with either fresh or spoiled milk to form an emulsion, which is easily effected, while this in turn, like milk alone, may be diluted to any extent, so that particles of oil will be held homogeneously in suspension. Thus, the question of applying oils in any desired dilution is settled, and something practical from them may be looked for.—C. V. Riley in *Scientific American.*

A NEW ENEMY TO CORN—THE LONG-HORNED DIABROTICA.—Several interesting articles have lately been published in the *Prairie Farmer* by Prof. Thomas, G. H. French and others, on the ravages of a larva which, on the 17th of August, Mr. French proved to be that of *Diabrotica longicornis* Say. The injuries of this insect to corn-roots have for some time been known to us, and the first record of the fact will be found in the introduction to our report as entomologist to the Department of Agriculture for 1878. We first received it in the larva and pupa states in August, 1874, from Mr. H. Weber, of Kirkwood, Mo., who found it burrowing in the roots of his corn, and doing considerable damage. While the general resemblance to the known larva of *Diabrotica vittata* (the Striped Cucumber-beetle) showed its relationship, and we suspected it to belong to *G. longicornis*, on account of the frequency with which this pretty, greenish species was found in corn fields, yet we failed to get positive proof by breeding until August 14, 1878, when the first beetle was obtained from larvæ received the previous month from Mr. G. Pauls, of Eureka, Mo. We have invariably found it in conjunction with a real wire-worm, viz.: the larva of *Drasterius amabilis* Lec., which, from its having been found by us preying on locust eggs, probably frequents the corn roots for the food afforded by the *Diabrotica* larvæ. The following from the *Western Rural*, of May 18, 1879, doubtless refers to these two larvæ:

INFORMATION WANTED.—During the last few years our corn fields in this section have been infested by a small white worm or larva, of which farmers generally know but little. Except in size, color and habits, it resembles the yellow wire-worm. Instead of disturbing the kernels of corn they attack the root, and soon as corn is up we find the roots dying and the inside of them filled with these little pests. They enter the root at the base of the stalk and burrow under the bark of the root until it is destroyed. They are at first very small and can scarcely be detected with the natural eye, but later they appear to be one-half inch in length, with seemingly all appearance of the wire-worm in shape. Some are claiming them to be the young wire-worm, while others claim different, and a few lines from your valuable paper might give us some light, and would be very acceptable to many farmers.—*N. A.*, *Swan Creek, Ill.*

The damage the present year in some of the Western States seems to have been considerable, and the only remedies that suggest themselves, in case the pest becomes more serious, are rotation of crops, the destruction of the Ragweed (*Ambrosia trifida*) upon which the beetles congregate, and the application of lime and ashes around the young corn to ward them off.

MIGRATIONS OF POTATO-BEETLES.—A curious sight in the counties of Passaic and Bergen, in New Jersey, is the migration of the potato-bug. Meadows, wagon roads, and railroads swarm with these pests, all moving westward. In some places they are so thick upon the rails of the railroad as to impede travel on an up grade. Where obstacles are met they turn out of their way. Great numbers are destroyed by the feet of travellers and the wheels of moving trains, but the gaps thus made are soon filled. On the coming of cold weather they immediately go into the ground. A lady in Hackensack avers that she swept up a peck at one time in her front hall. They are a plague in that section, creeping into houses and entering all rooms.—*N. Y. Sun.*

PHYLLOXERA CONGRESS IN SPAIN.—We have received a letter and circular from Mariano Royo, Commissioner of Agriculture at Saragosse, Spain, announcing that a Phylloxera Congress will be held at that place from the 1st to the 10th of October, for the consideration of all topics connected with the ravages of the Grape Phylloxera, and especially its injuries in Spain.

THE GRAPE PHYLLOXERA NOT PERMANENTLY DESTRUCTIVE.—Some of the vines in the vineyards in Solano County, Cal., which were deserted on account of Phylloxera-work, are reported as recovering. We have always believed, and have frequently expressed the belief, that even in Europe this pest will have its day, and that from various causes, not far to seek, the vine will be grown again on the very lands of late years ravaged. Catawbas, which for many years had failed in the vicinity of St. Louis, and in some instances were neglected and abandoned, have this year—where not killed outright—grown vigorously again, as we are informed by Mr. Isidor Bush; and the past four summers, which have been unfavorable to the Phylloxera there, have doubtless had much to do with the improved condition.

PHYLLOXERA REGULATIONS.—We learn that the Turkish Government has forbidden the introduction of any plants whatsoever into the territories of the Sultan. This wholesale interdict (supposing it were practicable to enforce it) has at least more logic and sense about it than the rules which permit a wagonload of hay to cross the frontier, but confiscate a rose in the buttonhole of a tourist.—*Gardeners' Chronicle.*

SHOWER OF WATER-BEETLES.—The people of Owensville, Mount Sterling, Sharpsburg, and intermediate places in Kentucky, were recently astounded by a veritable shower of large brown, oval-shaped beetles, measuring about one and a half inches in length by half or three-quarters of an inch in breadth. They proved to be the well-known water-beetle (*Dysticus rœselius*). Whether they were migrating, or had been swept into the air by a whirlwind, does not appear.—*Scientific American.*

[We have no species of Dytiscus of that specific name, but that does not alter the interest of the phenomenon recorded.]

The sale of silkworm eggs, as shown in a recent publication by the Franklin Institute, of Philadelphia, is an important industry. During the years 1874, 1875, 1876, and 1877, $6,000,000 worth of eggs arrived at San Francisco, for each of the years stated, from Yokohama, Japan, intended to be shipped by the Pacific railroad to New York, thence by steamers to Havre, France.

The announcement of the death, at Chickies, Penn., on September 10th, of Prof. S. S. Haldeman, in his 69th year, comes to us as a shock. We parted with him at Boston, not many days before the sad event, and he then seemed hale and hearty. Distinguished in several departments of Natural Science, as well as in Philology, he was well known to entomologists for his early writings upon insects, particularly upon the Coleoptera.

☞ We announce with regret the retirement of Mr. Fuller as assistant editor of the ENTOMOLOGIST. During the summer Mr. Fuller has been a great deal in New Mexico, whither his interests are liable to call him at any time. Though we shall miss his assistance, we hope and expect to often hear from him as a contributor, and as a fertile writer deeply interested in the subject of entomology, especially in its relations to horticulture and arboriculture.

ON OUR TABLE.

Evolution, Old and New; or the Theories of Buffon, Dr. Erasmus Darwin and Lamarck as compared with that of Mr. Charles Darwin. By Samuel Butler, Author of "Erewhon," "Life and Habit," etc. 8vo. pp. 384. S. E. Cassino. Salem, Mass., 1879. "Evolution and what is called Darwinism," writes Mr. Butler, "convey indeed the same main conclusion, but this conclusion has been reached by two distinct roads, one of which is impregnable while the other has already fallen into the hands of the enemy." It is the object of the present volume to endeavor to lead its readers into the "impregnable" road—so considered by the author—of purposiveness or teleology in evolution; and though it is "a perilous task to try and take evolution from the pedestal on which it now appears to stand so securely, and to put it back upon the one raised for it by its propounders," Mr. Butler undertakes it in these pages. "Not one person in ten thousand," he avers, "has any idea of what Buffon, Dr. Darwin and Lamarck propounded." He therefore gives a full resumé of the positions taken by these writers in regard to evolution, with a short biographical sketch of each, and long quotations from their respective works. And, though the reader's attention is chiefly confined to the above named three, nearly every writer who handled the same subject is made to contribute evidence for or against the question at issue; and the development of the conception is followed "as it has grown up in the minds of successive men of genius."

Appreciation of Mr. Butler's opinions will vary with the bias of his readers, but few will deny that he has produced a very interesting book.

American Grape Growing and Wine Making. By George Husmann, Prof. of Horticulture in the University of Missouri.

8vo. pp. 243. Illustrated. Orange Judd Co. New York, 1880.

More than fourteen years ago Prof. Husmann published a book on "Grapes and Wine," which attracted wide attention, and, as a guide to the operations of the vineyard, vintage and cellar, written by a practical worker, met a want felt by many. He now embodies, in the present work, not only the results of all his own labors and investigations down to the present time, but the methods and opinions of eminent grape growers in all parts of the country. Thus the work covers a wide range of experience and is adapted to every latitude. It treats of everything of importance bearing upon the culture of the vine, and is a complete guide for novices therein. Special attention is given to the Phylloxera.

Ninth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Fourth Annual Report by Cyrus Thomas, Ph. D. 8vo. pp. 142. Illustrated. Springfield, Ill., 1880. Those desiring to identify the species of Locusts found in the Mississippi Valley, will find in this report a useful series of descriptions and a synopsis by Prof. Thomas. It contains, also, an account of some of the parasites affecting domestic animals, and a valuable discussion on Cabbage Insects and the remedies to be used against them. The Pyrethrum powder, however, does not appear to have been tested.

Science. A Weekly Record of Scientific Progress. 4to. pp. 12. John Michels, Editor. New York. Subscription $4.00 a year, in advance. Single copy, 10 cents. This will be a welcome addition to our scientific periodical literature, if it shall take the place in the United States which *Nature* occupies in England. In presenting immediate information of scientific events, and in affording scientific workers the opportunity of promptly recording the fruits of their researches, it will prove invaluable. Subscriptions should be addressed to the Editor, Box 3838, P. O., New York.

Michigan Agricultural College. Experiments and other work of the Horticultural Department. By Prof. W. J. Beal 8vo. pp. 16. (Lecture delivered at Farmers' Institutes held at Rockford, Big Rapids and Mason.) From the Author.

Report of the South-African Museum for the year 1879. 4to. pp. 38. Cape Town, 1880. From R. Trimen, Curator.

The Transactions of the South-African Philosophical Society. Vol. I. 1877-80. Part III. 8vo. pp. 225. Cape Town, 1880. From R. Trimen, Genl. Secretary.

Notes of Observations of Injurious Insects. By E. A. Ormerod, F. M. S. 8vo. pp. 44. Illustrated. London, Eng., 1880. From the Author.

Note sur L'Horticulture en Angleterre. Par M. Ch. Joly. 8vo. pp. 15. (Ext. du *Journal de la Société centrale d'Horticulture de France*, Avril, 1880.) Paris. From the Author.

Chasse et Collection des Pucerons. Par M. J. Lichtenstein. 8vo. pp. 3. Montpelier, France, 1880. From the Author.

Les Pucerons du Térébinthe. Par M. J. Lichtenstein. 8vo. pp. 7. (Ext. *de la Feuille des Jeunes Naturalistes*. Paris.) From the Author.

EXTRACTS FROM CORRESPONDENCE.

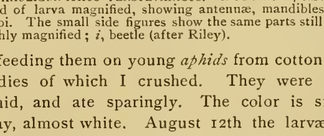
Ants vs. Cotton Worms.—*Aug. 25th.* The ants do not seem to attack the young larvæ and eggs of Aletia, which were crowded on the leaves, and yet they (the ants) swarm under the netting, and eat up pupæ placed in jars or boxes on the ground. I think this a very fair test of the work done by ants, since with every condition favorable, they fail to clear off young larvæ and eggs upon plants, at the foot of which they have very strong colonies. Under the oak tree, I find many leaves (cotton) scorched by the London purple, applied August 23d. I tried application of undiluted powder (London purple), blowing it from the bellows, and taking advantage of the wind, allowing it to float in fine clouds through the plants. I notice occasionally the brown swift, ground lizard, running over the ground in the cotton field. To-day one ate two caterpillars which I had knocked off onto the ground.—H. G. Hubbard, Centerville, Fla.

August 27th.—Several caterpillars dropped into the midst of a very strong colony of brown (stinging) ants, (No. 82), were very quickly destroyed; some of them made hardly any effort to escape. The same colony was experimented upon in the heat of the day, and four-fifths of the caterpillars escaped. I have been experimenting with an infusion of pyrethrum, made by pouring hot water (not boiling) upon the powder; but find it worthless.

August 28th.—Experiments made with a colony of brown ants (apparently same as No. 82), by dropping caterpillars in the path of a moving column, resulted in the escape of fifteen; five were killed by the ants. I have several times observed a column of the same species of ant engaged in robbing colonies of the common light testaceous ant, and at such times they are much less inclined to attack caterpillars dropped in their path. I have never yet witnessed the capture of a caterpillar upon the plant by ants, unless it had webbed up, and was stiffening to form pupa. During the hottest hours of the day the worms were more powerfully affected by the sting of this brown ant, and a greater proportion were captured by them at this time. During the heat of the day I observed that a caterpillar sometimes succumbed after being twice stung.—H. G. Hubbard, Centerville, Fla.

Early Life-History of Chauliognathus pensylvanicus.—The eggs of *Cauliognathus pensylvanicus*, which you gave me at Savannah, August 4th, (my No. 62,) hatched during the night of August 9th. On August 10th I mounted twelve of the larvæ in balsam (Slide No. 62). I succeeded

[Fig. 122.]



CHAULIGONATHUS PENSYLVANICUS. DeGeer: *a*, larva; *b*, head of larva magnified, showing antennæ, mandibles, and palpi. The small side figures show the same parts still more highly magnified; *i*, beetle (after Riley).

in feeding them on young *aphids* from cotton, the bodies of which I crushed. They were very timid, and ate sparingly. The color is silver gray, almost white. August 12th the larvæ retreated to bottom of earth in the bottle, and curled up in clusters. In two or three hours (10:45 A. M.) they had moulted. Their color now changed to a lead color, or mouse color. Immediately after moulting they became very active, climbing all over the sides of the jar. I gave them crushed *Phora aletiæ*, and they sucked the juice readily. They attacked the uninjured maggots, but were unable to pierce the skin. I preserved several in Wickersheim solution (No. 62, B). I gave them,

August 15th, a species of large, red *Aphis*, found on cockle-burr, but they did not relish them, and ate but little. They also ate sparingly of crushed *Aletia* larvæ, but prefer the *Phoras* to everything else. August 17th they retired to bottom of the bottle, and were torpid two days. August 19th all had completed their second moult, and are darker in color. They are now quite strong, and can pierce the skin of Phora maggots given them for food. The markings on dorsum are now quite distinct.—H. G. Hubbard, Centerville, Fla., Aug. 21st, 1880.

Vertebrate Enemies of Aletia.—*August 27th.* Heavy rains during last night. At four o'clock this morning I went into the field. The cotton was very wet, the air cool and foggy. I remarked at daybreak great numbers of night hawks flying slowly and very low over and among the cotton. From their actions I strongly suspect they were after moths, which were stirring. I saw also many bats similarly occupied, but did not observe them actually capturing Aletia. As soon as it became light, I saw a great many large dragon flies (*Aeschna* ?) hovering about the cotton.—H. G. Hubbard.

Oviposition of Asilus Fly.—I also observed a light yellow *Asilus-fly* ovipositing in the ground in an open space between the cotton-rows. She inserted her abdomen to a depth of half an inch, and deposited only three or four egggs, which I secured. During oviposition she imitated most comically the actions of a dog dropping its dung, and after finishing, immediately raked the earth into and over the hole, apparently very carelessly, but so effectively, that although I had marked with my eye the exact spot, I failed to detect it, until I unearthed the eggs. The eggs are oval, yellowish white, smooth and quite large.—H. G. Hubbard, August 27th, 1880.

Spider and Cotton Worm.—*Aug. 28th*, 1880. In the field to-day I observed a spider *Oxyopes viridans* eating a Tachinid (?) fly. These large, green spiders are quite common. I am inclined to think they do not attack the caterpillar. I watched one resting upon the same leaf with a worm, to which the spider paid no attention. During the entire morning the spider remained upon the same leaf, while the caterpillar wandered to the next leaf, and fed in plain sight of the spider unmolested. Another specimen of the same spider ran over a leaf, on the underside of which a caterpillar was feeding. The caterpillar jerked and shook the leaf, but the spider paid no attention to it.

Sept. 3d.—This morning I could not find a caterpillar in the "Simpson cotton," excepting one just hatched. I saw the green *Oxyopes* feeding upon a bee, *Anthophora* or *Megachile* or some bee of medium size. (I did not succeed in securing it). There are many burrows of a *Cicindela* larva, (probably *C. punctulata*, which is abundant in the cotton fields). They (the larvæ) capture ants chiefly.—H. G. Hubbard.

Boll Rot caused by Boll Worm.—The work of the Boll Worm is now fearful in Texas. I have seen nothing to compare with it in point of extent before. While the Cotton Worm is doing serious damage in certain localities, I find the Boll Worm operating with about equal energy all over the State. A letter from an intelligent planter at Pilot Point, received by me this week, reports it sweeping everything in all the counties bordering upon Red River. The press reports it everywhere.

Careful observation has shown me that the Boll Worm does more damage than it has heretofore had credit for. We have generally supposed that the extent of its injurious work consisted in boring into the bolls at some stage of their growth from the blossom down to maturity, but I find that a hole bored is not absolutely necessary to the destruction of the lint. The worm makes an attempt on large numbers of bolls which prove too hard for boring into, so it abandons them after having merely bruised the cuticle in a small spot, as it were. In almost, if not quite every case, at least half the lint of that bruised boll is ruined :—it rots under the bruise. In many cases the interior of the entire boll rots ; where it does not, it invariably matures an inferior grade of lint. The planters call it the "Boll Rot," but seem to have no idea as to the cause of it. I claim the discovery, for I find it always the result of the bruise, and I have several times detected the worm in the act of making the bruise. I now have experiments pending to show whether or not similar bruises made by scraping the surface with a knife will rot the boll.—J. P. Stelle, Calvert, Tex.

Sudden Increase of one of our large Locusts.—*Acridium americanum* has appeared at one point in this county, near here, in greater numbers than ever before known. Horses have been frightened in passing through them along the road. They are injuring orchards. This shows how soon very dry weather, such as we have recently had, may bring them forward.—Cyrus Thomas, Carbondale, Ill., Aug 28, 1880.

Effects of Pyrethrum on different Insects.—I am trying every day experiments with Pyrethrum powder. I find very little difference between the sample of imported powder sent me and the California Buhach. The latter is somewhat stronger, but the difference appears very slight. Tried upon different insects, it appears to affect the higher *Hymenoptera* more than other insects. Ants are almost instantly affected. Wasps continue feeding for about twenty seconds, and are violently affected in from one to two minutes.

Larvæ of all kinds are more quickly affected than imagos. Termites, owing probably to their tender bodies, are instantly affected and soon killed. Spiders resist longer than anything else. They sometimes change their skins when dusted with the powder. *Copris* and *Phanæus* are slightly affected, and long resist the action of the powder. *Scolopendridæ*, affected similarly to spiders. Bugs, slightly affected, especially the large and heavily armed predaceous species. Large grasshoppers, slightly affected. Roaches, very violently affected. These observations refer to the immediate action of the dry and undiluted powder, and are comparative only. There is no doubt that insects often recover from slight applications.—H. G. Hubbard, Centerville, Fla., Aug. 25, 1880.

Modification observable in Locusts.—*Œdipoda atrox* (*Camnula pellucida*) shows indications of a *transformation* (if I may use the term) into a true migratory species; the posterior abdominal segment of the male is becoming more elongated and tapering, and a terminal notch is appearing more distinctly than in specimens I have heretofore examined. The wings of specimens just received from Mr. Lemmon appear to me longer than in specimens previously observed.—Cyrus Thomas, Carbondale, Ill., Sept. 7.

Plant-feeding Ground-beetles. — The other day at Ammendale, Md., *large numbers* of a black predaceous beetle (*Harpalus caliginosus* Say) were noticed in rather tall plants of the common ragweed (*Ambrosia artemisiæfolia*), and, supposing that they had ascended the plants to prey on some herbivorous insect, or possibly on insects that might be attracted to the flowers, I looked to see what they were after, as I knew that they sometimes leave the ground in search of food. Judge of my surprise at seeing them busily engaged in eating the contents of the partly-grown fruit of the plant! Several of them were watched as they busily gnawed out the fleshy albumen of the seed, so that I am sure of the fact. Is it usual for these beetles, that are commonly supposed to be purely carnivorous, to indulge in vegetable food?

The same fact was also observed by my friend, C. S. Sheldon, at the same time.—Wm. Trelease, Washington, D. C., Sept. 13, 1880.

Ants vs. Aletia again.—Aug. 23.—Put many chrysalides of *Aletia* at the openings of ant-hills of all the species I could find, including the noted "Agricultural Ant" (*Pogonomyrmex barbatus*), which is quite common here. When first put down the ants tugged at the small extremities of the chrysalides a few moments, after which they left them undisturbed. In not one of the species was there evinced a disposition to break the shells. Finally I crushed several chrysalides until the juices appeared; these the ants of each species worked upon vigorously until they were devoured or dragged piecemeal into the formicary. I placed a full-grown boll-worm in the thickest of a strong colony of *P. barbatus*. The ants ran over the larva, and a few seemed to give it a bite, but they showed no disposition to overpower it, allowing it to crawl off in its lubberly way, and escape.

In the evening I visited a strong colony of *P. barbatus*, where I had left many chrysalides, including a number still rolled up in the leaves. The ants were found busily engaged cutting the dried leaves to pieces, evidently with the intention of removing the rubbish from their "clearing," for they keep everything cleared away for a space ten or twelve feet around their entrance, not even sparing cotton plants. Several leaves had already been removed, but the chrysalides which the leaves had contained were lying upon the ground undisturbed, they being too heavy to remove, and the ants, from some cause or other, having declined to cut them in pieces.

Aug. 24.—Visited the ants early to learn what they had done about the chrysalides. Many of the smaller species were out and at work, but the "Agriculturals" had not yet opened their doors, which they close up regularly every night; but all the chrysalides were gone;—where and by what taken I have no idea.

Aug. 26.—Offered many eggs to the ants, but did not succeed in getting them to take a single egg from a leaf, although they would seize upon it and carry it off if I broke it loose for them. I do not believe ants will break an egg from a leaf. Until broken loose or crushed by me I can not get them to notice the eggs in the least.—J. P. Stelle, Calvert, Tex.

London Purple in Texas.—Wherever the London Purple was used it was most decidedly approved as being the speediest, the cheapest, and the least hurtful to the growing crop and the persons applying it; some of both classes of laborers affirming that sores on their hands had been healed by the time they got through with their work, and I could hear of no injury to man or beast. I did not find a solitary exception to this view of the case. The London Purple, upon your endorsement, was more extensively used in this quarter than any other portion of the State. —William J. Jones' report from the Colorado Bottom, Texas.

Road Dust vs. Cotton Worms.—A much traveled road runs east and west through the field; on the south side of it the cotton is badly eaten by worms, while for forty feet along the north side it does not seem to have been much disturbed. I investigated for the cause of this exemption, and found it to be the result of a south wind blowing the dust stirred up in the

road over the plants. It seems to have at least retarded the work of both boll and cotton worms. —J. P. Stelle, Calvert, Tex.

Pyrethrum Roseum.—The only species of its genus which gives a good, effective insect powder is nowhere cultivated, but grows wild in the basal-alpine zone of our mountains (6–8,000 feet). I intend to again visit the mountains shortly, and shall try my best to comply with your request, and think to send you, in September, about one pound of the seed, collected by myself. Whether the cultivated plant will have the same excellent properties as the wild one, I cannot decide. The insect powder of the market is recently much adulterated, but the genuine, pure powder of *Pyrethrum roseum* is most excellent for every injurious insect. This I can vouch for. The plant is perennial, so that, if you succeed in cultivating it, the produce is plentiful.—Dr. Gustav Radde, Tiflis.

Boll Rot.—I send you by to-day's mail a small box of cotton bolls as a sample of the rot which is now doing great damage to the cotton crop in this section. This species of rot is known among old planters as the "greasy" rot, and is a sequel or result from either very wet or dry summer. This year it is the result of extreme wet weather. It is called "greasy" rot from the first appearance of the little spots which show themselves on the bolls. These spots soon turn brown, and the whole boll is soon rotted. It is principally the top crop which rots. For several seasons I have thought that this rot was caused by an insect puncturing the boll for the purpose of depositing eggs. When the bolls are fully rotted, quite a number of worms—small, white, with very hard heads—are found in them. It may be that these worms are a species of maggot deposited in the boll after it commences to rot. The rot may be a kind of mildew. [1.]

The Cotton Worm has behaved very singularly in this region, having been sufficiently numerous early in August to have propagated sufficiently to destroy the cotton crop by September 10; but they have gradually decreased, in spite of favorable rainy weather, and now there are very few of them. The birds and ants are very numerous, and also the little fly which destroys the eggs. [2.] Prof. Barnard found so little chance for observation here that he went up the river.—P. S. Shields, Vidalia, La., Sept. 10, 1880.

[1.—There is little question but that this kind of rot proceeds from a puncture or the gnawings of the Boll Worm, as Prof. Stelle has recently proved. Your specimens corroborate this fact. Both the fungus and the maggots are after effects. 2.—The natural enemies, no doubt, kept the worms in check.]

London Purple.—Most of the farmers out here use Paris Green, but I persuaded several to try London Purple, and all report excellent results, and I used it myself upon several kinds of bugs and on the Army Worm. I like it much better than Paris Green, and it works better in my case —does not settle so quick. I think it is bound to take the place of Paris Green, which is being adulterated so much that it is almost impossible to get the genuine. I shall recommend it highly next year.—S. H. Fox, St. Louis, Mo., Sept. 20.

Effect of Pyrethrum on Boll Worm.—Aug. 27th—Sprayed extract Pyrethrum (Buhach) on stalk of cotton containing three small Heliothis: one of these was partially in the ball, the other two were on the flowers. The extract was made by taking half a tin package of Milco's Buhach, introducing it into a glass flask, adding half gallon of 95 per cent. Ethyl Alcohol, allowing it to stand corked for (24) twenty-four hours; I then introduced a tube of glass thirty-six inches long and one-fourth of inch in diameter into the cork, and then subjected the flask and contents to the gentle heat of a water bath, never allowing the heat to reach the boiling point of alcohol. This gentle heat was continued five hours and the flask then set aside to cool. When cool, before using, the liquid was diluted with twenty times its volume of water. In five minutes after the application of the diluted extract to the stalk by means of a sprinkler, the three worms fell to the ground and rolled over and over as if in pain, at times they attempted to crawl off but would be siezed with convulsions. They did not get far from the stalks from which they fell, but lived more than six hours, dying sometime during the night.

2. Sept. 17th—In the following experiment I used some of the same extract spoken of in preceding experiment. The quantity this time was half pint extract to five pints water. I selected a spot in the cotton field where Aletiæ were tolerably numerous. There were three stalks of cotton growing close together, and the vines of Morning Glory had densely intertwined themselves with these three plants, making the foliage very thick and hard to penetrate. I caught a number of Aletiæ from other stalks of cotton and put them on these until I could count 120. In all this time neither I nor either of the gentlemen present to witness the experiment noticed a boll worm (Heliothis). I used a small fountain pump made by Rumsey & Co., Seneca Falls, N. Y. We sprayed the diluted extract over three rows for about twenty feet, throwing more upon the three plants mentioned than elsewhere. Whilst the spray was falling upon this thick foliage I closely watched its effect: to my surprise a large Heliothis appeared on a leaf, seeming to be bewildered and making rapid exertions to get off. On examination I found it had come from the interior of a full grown boll on which it was feeding; the orifice it had cut was on the upper side, and I suppose some of the fine spray passed through the orifice, and disturbing it in its excavations, caused it to come forth. Soon after it appeared it crawled on a leaf which

had been slightly wetted with the extract, and in two minutes from the time the extract was thrown on the plants this Heliothis fell to the ground, and after convulsions, rolling, crawling, twisting, which lasted an hour and a quarter, it died. In four minutes about half of the Aletiæ had fallen to the ground and were in convulsions, the younger worms falling first. At the end of one hour there were but four larvæ of Aletia on the cotton that had been reached by the extract, and these were evidently much affected by it, so that I think they will die. I regret that the number of boll worms is so small since these excessive rains and cold weather that I experiment under difficulties. Some chrysalides of Aletia were on the cotton to which I applied the diluted extract in this experiment; I am keeping them carefully to see if they retain vitality.—R. W. Jones, Oxford, Miss.

Boll Worm devouring Cotton Worm.—I went to Holly Springs to-day, to visit a field near that place, in company with Judge Lawrence Johnson, in which the cotton had been fearfully "ragged" by Aletia, and in which great damage has been done by Heliothis. The upper leaves of the plants, in a large part of the field, have been consumed, excepting the "ribs," and there are thousands of chrysalides. The bolls are getting old and tough now, and the boll worms have turned to eating the chrysalides of Aletia. I discovered this soon after entering the field, and called Judge Johnson's attention to it; we both saw the Heliothis eating the chrysalides of Aletia. Another fact: we saw Aletia eating young bolls and their contents in places where the leaves had been consumed.

I have noticed, in many instances, that when the Boll Worm eats the contents of a boll, and the excrement is exposed on the boll to the rain for some time, that it is relieved of certain coloring matter, and seems to be unchanged cellulose, having the fibrous structure of cotton when the ball opens naturally. This shows that the food of Heliothis, that which nourishes it, is the juices and seeds of the young boll. I do not know that this last fact is of any special practical value, but it seems to me to be exceptional. —R. W. Jones, Oxford, Miss., Sept., 24, 1880.

Insect Enemies of Growing Rice.—I inclose a letter from Mr. John Screven, Savannah, Ga., relative to the depredations committed on growing rice by two larvæ (one of them evidently of a Scarabæid). He has sent me specimens of each kind of larva, which I forward to you to-day by Adams Express.

Will you have the kindness to enter into correspondence with Mr. Screven, and give him such instructions as will enable him to collect specimens of the perfect insects, and to furnish you with such additional points in the history of these destructive pests as may be useful for publication.—J. L. LeConte, Sept. 15, 1880.

[We shall publish in our next number, the interesting communication which Dr. Le Conte so obligingly incloses, and we quote further from Mr. Screven's letter:]

I also send specimens of what planters call the "Grub." It infests the rice fields, especially in mold lands, beginning its work in June, before the harvest flow is put on the fields. Inundation is the only remedy for them, and is effective, as it is peculiarly a dry-land worm. Like the "Maggot," it attacks the roots of the rice, and is very destructive in its ravages.

"The "Maggot" is a water, and the "Grub" is a dry-land insect. Drying the fields for a few days is the remedy for the one, and inundating them is the remedy for the other. In the course of a crop, lasting in its cultivation, say 160 days, the fields are dry during 80, and inundated during 80 days. They are again dry from September to March. One would imagine that either remedy would suffice in its respective application to *extirpate* both "Grub" and "Maggot," but still they come from year to year, born, as it were, out of nothing!

I would be glad to have the opportunity and the privilege of sending you other specimens of the insect enemies of the rice plant—as, for example, the "Caterpillar" and "Water Weevil." The latter is so called because it resembles closely, in form and size, the ordinary grain weevil. It is a water insect, feeding on the tender formation between the frame-work on the leaves of the young plant when it is in the "Stretch Flow," giving a pale, sickly hue to the field, and sometimes destroying the plant by the extirpation of its breathing apparatus. The "Water Weevil" makes its advent in April, and disappears in May.

[The "Grub" is evidently the larva of a beetle belonging to the family *Scarabæidæ*, and, apparently, to the genus *Ligyrus*. The larvæ in this genus are known to develop very rapidly, and one species (*L. rugiceps* Lec.), is very common in the South, and destructive, in the beetle state, to the roots of sugar-cane and corn (see May No. of this magazine, p. 130). The "Maggot" is unlike anything we have in our cabinet. It is apparently Coleopterous, but bears no resemblance to *Donacia* larvæ, which occur under water, or to the *Sitophilus oryzæ*, which infests the rice grain. It resembles most those of certain small Longicorns belonging to the genus *Oberia*. We should be pleased to have you send us, if possible, the other stages of these insects. If allowed to attain their full growth, and watch be kept upon them, you will observe into what form of winged insect they change. The connection of the "Maggot" with putrescence is worthy of investigation, for an examination of the specimens sent does not indicate that the insect is necessarily connected with the putrescence. In order to combat the evil, one of the most important points to learn is, what becomes of the insects after the crop is gathered; and in order to determine this it is necessary to watch them through their transformations.]

ANSWERS TO CORRESPONDENTS.

Blind-eyed Smerinthus.—*Mrs. J. B. Harrison, Franklin Falls, N. H.*—The moth you send, which flew into the house at lamp-light, is *Smerinthus excæcatus* Smith, the larva of which feeds upon apple. The species is, however, not common enough to do any serious damage.

White waxy Secretion on Stems of Bitter Sweet.—*J. A. L., Albany, N. Y.*—The white waxy secretion, usually with transverse ribs, upon the stem of the *Scelastrus scandens* is produced by the Two-spotted Treehopper (*Enchophyllum binotatum* Say), for a covering to its eggs. This insect is found upon the Grapevine, the Redbud and a number of other trees and shrubs, but more particularly upon the Hop tree (*Ptelea trifoliata*). We have in past years hatched it from the eggs. The waxy matter is generally transversely ribbed, and under each mass is a small scar. The eggs are normally placed so as to slope one way and spread out from the mouth of the scar, under and just beneath the bark. The wood is not deadened. Each egg is 0.9 mm. long, broadest at base, extremely delicate, watery-white in color, with a faint tinge of orange near the tip. We have found the recently hatched larvæ on the 10th of May, and they went through their first molt on the 18th. Some went through their third molt June 5, and changed to the perfect insect June 12. They do not jump until they acquire wings, and the larva does not possess the peculiar beak-like prolongation of the thorax which is so conspicuous in the perfect insect.

Prickly Ash Larva: Tachinid Eggs.—*R. W. Jones, Oxford, Miss.*—The larva on Prickly Ash is that of *Papilio cresphontes* Cram. The eggs on Cotton Worm are those of Tachina fly. One of the worms succeeded in transforming to chrysalis and shedding an egg on the cast skin before the Tachina maggot hatched.

Insects affecting Cotton Plant.—*E. Jardin, Rochefort-sur-mer, France.*—We shall take pleasure in forwarding the desired information for your work on Cotton as soon as we can find time.

Worms on Cabbage: Boll Worm Feeding on Leaf.—*R. W. Jones, Oxford, Miss.*—Your No. 22, feeding on leaf of Cotton, is *Heliothis armigera*. It frequently so feeds, especially toward the end of the season. The worms on cabbage, rutabagas and turnips, are *Pionea rimosalis*. See p. 22, January number.

Buggy Peas.—You will please find inclosed "buggy" peas. The insect is quite a pest in this section, where peas are raised in large quantities. Can you suggest a means of destruction or prevention? I suppose you are familiar with the habits of the insect. Any information would be very thankfully received by yours—Alex. Berger, Milwaukee, Wis., Sept. 24, 1880.

We refer you for the natural history of the Pea weevil (*Bruchus pisi*), to our 3rd Mo. Ent. Rep. (pp. 44–50), from which we quote:

Many eminent seedsmen—Mr. Langdon, for instance, as I have been credibly informed—effectually kill the weevils by inclosing the peas in tight vessels along with camphor. The same object is attained by keeping peas two years, and taking care that the beetles do not escape before they die. Peas will grow well when kept for two years, or even longer, but they should always be well dried so as not to mold. A good plan is to tie them up in bags and hang them in an airy place from the time they are gathered till about Christmas, and then, in order that they may not become too dry, to put them into tighter vessels.

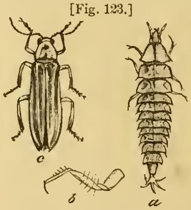
Another quick and effectual way to kill the weevil, is to inclose the peas in a tight vessel, and pour among them a small quantity of bisulphide of carbon.

Glow Worm.—I inclose in the accompanying box a species of phosphorescent insect—probably a "Glow Worm"—the first I ever saw in this country. I found it at Chatham, Morris County, N. J., on Monday evening last. It was on the ground, and when found was emitting a brilliant light, which it seemed to control at will. I would be obliged if you would favor me with the classification of this little insect.—James J, Dean, New-York, Sept. 22, 1880.

Your insect is the larva of *Photuris pensylvanica* De Geer, and as a fuller reply to your question, we reproduce from the *Country Gentleman* for January 6, 1870, what we said of it then:

EDS. COUNTRY GENTLEMAN—The Glow Worm spoken of by "B," of West Hartford, Ct., on page 322 of your last volume, and which you were kind enough to send me for determination, is the larva of the Pennsylvania Fire-beetle (*Photuris pensylvanica* De Geer). It so happens that I have traced this very species through its transformations, and I consequently had no difficulty in recognizing it. There are two beetles in the United States, both commonly called "Fire-flies," which are now known to be luminous, in their larval as well as in their perfect states. The other species (*Photinus pyralis* Linn.), was figured for the first time in its three different stages, in the *American Entomologist*. Vol. 1, p. 19, and I present herewith figures of the species you send—*a*, showing the larva, with the characteristic brush-like proleg, which is retractile; *b*, one of its legs magnified, and *c*, the beetle. Both the males and females of these two species of "Fire-flies" have wings, and therein they differ from the true Glow Worm of England (*Lampyris noctiluca*), the female of which is wingless, and emits a much more brilliant light than does her winged mate.—C. V. Riley.

[Fig. 123.]



PHOTURIS PENSYLVANICA.—*a*, larva, dorsal view; *b*, one of its legs enlarged; *c*, beetle (after Riley).

THE

American Entomologist.

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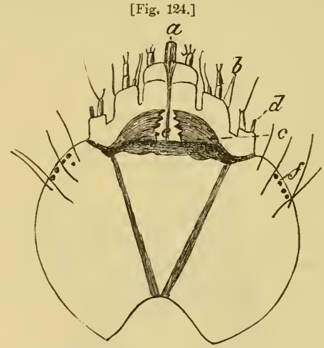
ON THE CHANGES THAT TAKE PLACE IN THE MOUTH-PARTS AND LEGS OF SOME LEAF-MINING LEPIDOPTEROUS LARVÆ.

BY V. T. CHAMBERS, COVINGTON, KY.

In my address as President of the "Cincinnati Society of Natural History," (*vol. 2, p. 71 of the Journal of the Society*), I have given some facts as to the metamorphoses of the mouth-parts of certain Tineid larvæ; and, at the request of the editor, I submit these facts, together with some others, both upon the mouth-parts and legs of these larvæ, to the readers of the AMERICAN ENTOMOLOGIST.

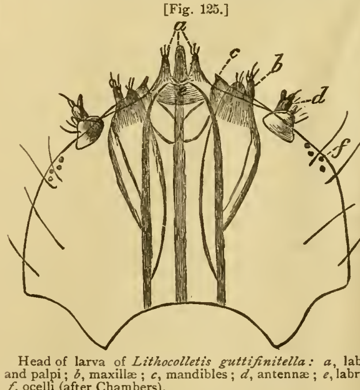
If we examine the mouth-parts (or *trophi*, as they are technically termed,) of any ordinary caterpillar, whether of the macro or micro-lepidoptera, we shall find that they consist of an upper lip or labrum; two strong jaws or mandibles; two weak jaws or maxillæ; and a labium; and the maxillæ and labium are each provided with a pair of feelers or palpi; in other words, it is a typical insect mouth, possessing all of the parts of such a mouth moderately developed. Differences in the development of the different parts in different species will be detected, but typically the mouth-parts are the same. In addition to the parts above-named, the labium will be found to be armed with a spinneret which, however, with the silk glands, is believed to be only a special development of the salivary glands and duct of other larvæ. Such trophi are represented in Figs. 124 and 125. In Fig. 124 the organs are extended, and in Fig. 125 they are retracted. These figures are typical of the ordinary form of Lepidopterous larval trophi.

[Fig. 124.]



Larval head of *Lithocolletis ornatella* in seventh stage: lettered parts as in Fig. 125 (after Chambers).

[Fig. 125.]



Head of larva of *Lithocolletis guttifinitella*: *a*, labium and palpi; *b*, maxillæ; *c*, mandibles; *d*, antennæ; *e*, labrum; *f*, ocelli (after Chambers).

The larvæ of *Lithocolletis* are divided into three groups, known as the flat, the *ornatella* or intermediate, and the cylindrical groups. In the flat group, the larvæ in their first five stages are flat, have membraneous, retractile thoracic, ventral and anal legs, and trophi of the "first" form. At their 5th molt they become vertically thickened and more cylindrical, and assume trophi of the "second" form, with, however, the mandibles small and functionless; their 7th stage is like the 6th, they never acquire articulated legs, and they pupate in the mine. In *L. ornatella* the first five stages resemble the first five of the flat group, but the larva is not so much flattened; but at the 5th molt the larva becomes approximately cylindrical, has well-developed articulated thoracic legs, and trophi of the 2d form, with the mandibles large and strong. Neither of these groups of larvæ eat anything in the 6th and 7th stages, and *ornatella* (the only known representative of its group), leaves the mine to pupate. The larvæ of the cylindrical group, in their first three stages, resemble those of the two preceding groups, being flat, with trophi of the first form and membraneous legs, but they are more elongate and slender. But at the 3d (instead of 5th) molt, they acquire well-developed articulated thoracic legs, with trophi of the second form, and large, strong mandibles, and a cylindrical form; they, like the flat group, pupate in the mine. The larva of *Leucanthiza amphicarpeæfoliella* (Clem.), the only representative of the genus, in form, structure, history and habits resembles very closely *Lithocolletis ornatella*. The larvæ of *Gracilaria*, *Ornix* and *Coriscium*, in their first stage, resembles those of the flat group of *Lithocolletis*, but at their first molt they acquire a cylindrical form, well-developed thoracic legs, and well-developed trophi of the second form, and then resemble the larvæ of the cylindrical group of *Lithocolletis*. They have only five larval stages, and their habits as to pupation are various. Some never leave their mines except to pupate. Some leave one mine and make another after their second molt; and some, after that molt, feed externally. All the larva above mentioned have three pairs of thoracic, three of ventral, and one of anal legs. The larvæ of *Phyllocnistis* have no thoracic legs, but have eight pairs of membraneous retractile abdominal legs, and an anal pair. They are flat, with trophi of the first form, except in their last stage, when they are oblong-conical, and have greatly aborted trophi of the second form. They pupate in the mine, which they never leave until the imago is disclosed.

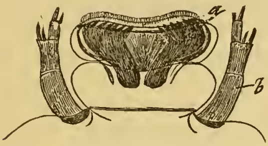
These facts have been elsewhere previously stated by me, but for the better understanding of this paper it is deemed best to repeat them here.

Fig. 124 represents the trophi of the larva of *Lithocolletis ornatella* Cham., and Fig. 125 those of *L. guttifinitella* Clem. in their 7th and 6th larval stages; but, as will presently be shown, they are very different from the trophi of the same species in the five preceding larval stages; as, indeed, will be evident at a glance, by comparing Figs. 124 and 125 with Fig. 126, which represents trophi of larvæ of either species in their first five stages. In Fig. 124 and 125 "*a*" is the labium with spinneret, and with the palpi on each side; "*b*," maxillæ with palpi; "*c*." mandibles; "*d*," antennæ; "*e*," labrum and "*f*," eyes. The only notable difference in these figures is that the mandibles are much larger in Fig. 124 than in Fig. 125. I formerly thought that this difference might be owing to the different habits of the larvæ. The larvæ of *L. guttifinitella*, and all of the allied species, forming what is called the flat group, in allusion to their form, do not eat after their fifth molt; and never leave the mine; and, except that they spin their cocoons in the 7th stage, their 6th and 7th stages are as completely quiescent or resting stages as is the pupa state. Neither does the larva of *L. ornatella*, (which, of itself, forms the second group) eat in the 6th and 7th stages; but in its 7th stage it cuts a lunate slit in the cuticle of the leaf; leaves its mine, and crawls away to pupate elsewhere.

The larva of *L. ornatella* is also, in its 6th and 7th stages, supplied with well-

developed articulated feet on the thoracic segments, and its pro-legs are armed with the circle of hooklets, as in ordinary caterpillars. In the flat group of larvæ, however, the jaws are not only greatly aborted and functionless in the last two stages of larval life, but the thoracic feet, as well as the ventral ones, are membraneous, and neither set is armed

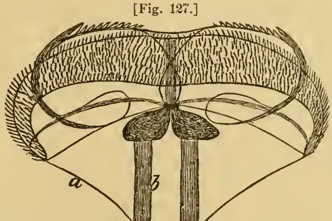
[Fig. 126.]



First form of trophi and antennæ in *Lithocolletis guttifinitella* (after Chambers).

with either claws, or the circlet of tentacles. These differences of structure would seem to be correlated with the differences of habit above mentioned; but if so, what shall we say as to the larvæ of the third group of the same genus, comprising the majority of the species, and in allusion to the form of the larvæ called the "cylindrical" group? These larvæ are flat in their first three stages, as are those of *ornatella* and the flat group, in their first five stages. But at their third molt they undergo the same changes of form and of trophi and feet that *ornatella* does at its fifth molt,

[Fig. 127.]

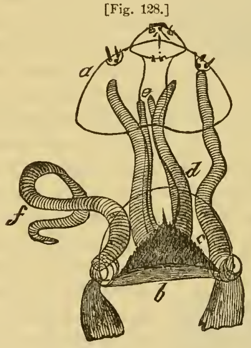


First form of trophi in *Phyllocnistis vitifoliella* (after Chambers).

and are, therefore, structurally as capable of leaving the mine and crawling away as is the larva of *ornatella*. Yet, they not only do not do so, but continue to feed in the mine, and pupate there. This, however, is apart from my present purpose. The fact, however, indicates that the development of the jaws and feet is independent of the habit of leaving the mine, and is also independent of their habits in the mine.

I have already referred to the form of trophi, shown in Fig. 126, as different from the form shown in Figs. 124 and 125. Fig. 126 represents what I call the first form in allusion to the time of larval life when it is exhibited; Figs. 124 and 125 represent in the same way the second form, and is, as before stated, the form found in ordinary caterpillars when they leave the eggs; and, indeed, in all caterpillars, so far as is known, except in the earlier stages of the larvæ of the genera *Phyllocnistis*, *Lithocolletis*, *Leucanthiza*, *Coriscium*, *Gracilaria* and *Ornix*; and it is found in the later stages of them.

[Fig. 128.]



Phyllocnistis vitifoliella: *a*, head of last larval stage; *b*, head of immature pupa pressed of the larval head.

The difference consists not only in the different size, form and degree of development of the different organs, but in the presence or absence (apparently) of some of the organs themselves. Thus, in the first form (Fig. 126), only labrum, mandibles and labium have been detected; the spinneret is *very* rudimentary, and there is no trace of either maxillary or labial palpi, or of maxillæ.* In the second or ordinary form not only are the labrum and labium greatly altered in form and size and rela-

* In the larvæ of the flat group, in which the trophi of the first form attain their full size at the end of the fifth stage, and in which they are larger than in any other of the genera or species mentioned, their width is only 1-150th inch; length about 1-300th inch; and vertical thickness not more than 1-2000th of an inch. The front margin of the labrum is scalloped and flexed downwards in the middle (Fig. 126), so that the teeth of the mandibles appear in a focal plane above the labrum, which is dentate and ciliated in some species. These facts, with the result of my first dissections (made with needles), induced me to think, and to state in the address above referred to, that the maxillæ were united above the labium, forming

tive importance, but the spinneret is well developed, as also are the maxillæ, and both pairs of palpi. If now we pass on to the pupa and imago, we find that the mandibles, labrum and labium have disappeared, or are greatly aborted and functionless, whilst the maxillæ and one or both pairs of the palpi are relatively greatly developed. In other words, precisely those organs which have the greatest development in the earliest larval stages are aborted and functionless in the imago, and *vice versa ;* whilst the second or ordinary form of trophi is an intermediate state in which all of the organs are relatively well developed. Reverting to the six genera before mentioned, in which alone, and only in their earlier stages, the first form of trophi has as yet been found, we find that in *Phyllocnistis* the larva passes through only two stages before becoming a pupa; the first is its active feeding stage, lasts about three days, and is characterized by the first form of trophi (Fig. 127,) and by the absence of all true legs, and by the presence of a retractile membraneous appendage, or pseudopodium, slanting downwards from each side of each ventral segment, except the last, from the apex of which there are two long ones. In its second stage, which lasts not more than a day, it has trophi of the second form, but with all of the organs except the spinneret aborted and functionless (Fig. 128 *a*). It still has no true legs, only the lateral and anal pseudopodia above mentioned. It pupates in its mine, and the pupa has maxillæ and labial palpi, jointed legs and wings. Fig. 128, *b*, represents the head of an immature pupa. The organs (*f*) antennæ, (*d*) maxillæ and (*e*) labial palpi, filled the empty cast (*a*) of the larval head, terminating in the corresponding parts thereof; but in mounting the specimen for preservation as a microscopic object, they have been pressed back and thrown out of position. (*c*) represents the cephalotheca. In the first form (Fig. 127) the labium is large and capable of great protrusion and eversion, and they are presented in this condition in the figure; when they are retracted the rod, *a*, disappears, being concealed in a groove in the side of the rod *b*.

The labium of *Gracilaria robiniella* in its first larval stage resembles that of *Phyllocnistis*, and, as just stated, all the trophi of *Corisciurn* resemble those of *Phyllocnistis* in that stage. The labrum of *Gracilaria*, Fig. 131, is, however, quite different from that of *Phyllocnistis*, Fig. 132, and *Coriscium*, and resembles that of *Ornix*, Fig. 130. But the labium of *Ornix*, as shown in Fig. 143, is very different from all the others. In all their stages, except the first larval one, the larvæ of *Gracilaria*, *Coriscium* and *Ornix* are very closely allied, and differ widely from *Phyllocnistis*, resembling rather the cylindrical larva of *Lithocolletis*.

The next genus is *Lithocolletis*, on which I have already commented. Fig. 126 represents the first form of trophi in this genus; in the first three stages of the cylindrical group, and in the first five of the other two groups; Fig. 124 represents the second form in the last four stages of the cylindrical group, and in the last two of the *ornatella* group; whilst Fig. 125 represents it in the last two stages of the flat group. The changes which take place in the genus *Leucanthiza* are identical with those in the *ornatella* group of *Lithocolletis*. The genus is nearly allied to *Lithocolletis*, but shows some structural resemblance to *Phyllocnistis*. I was formerly led to the conclusion that the changes in the trophi occurred in the genus *Gracilaria* at the third molt; this, however, is an error; in all of the species that I have examined in this genus, and in the very closely allied genera *Coriscium* and *Ornix*, it takes place at the first molt. The larvæ in the first stage have trophi of the first form, and in the second and subsequent stages of second form. I have not seen the larva of

the floor of the mouth. This is incorrect; there are no maxillæ, and what I then supposed to be the maxillæ was the toothed and ciliated labrum, as I have since demonstrated by other dissections. Organs of the dimensions above given are difficult to dissect with instruments, as they break and tear, and their true relations may be misunderstood. But if the head of the larva is cut off (or its cast-off skin will do), and mounted as for microscopic examination in glycerine and gum water (Farrant's medium of the microscopists), and set away for a few hours until it is permeated by the fluid, which has had time also to become stiff; and if the slide and glass are then clasped tightly between the thumb and finger, and a turn given to the slide, the mouth-parts will separate so that each will be shown separately and distinctly.

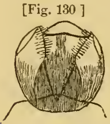
Coriscium in its first stage, and cannot tell whether or not it has the lateral pseudopodia as in *Phyllocnistis* or not; and I have not found them in the first stage of either *Gracilaria* or *Ornix* (but, as they are retractile, they may nevertheless exist). I have seen the cast head of *Coriscium albanotella* of the first stage.

[Fig. 129.]

Labrum of first form of trophi in *Ornix inusitatumella* (after Chambers).

It resembles so closely that of *Phyllocnistis*, that it is unnecessary to figure it. In all of its subsequent stages however (four), it is very closely allied to *Gracilaria*, as also is the genus *Ornix*. But these two genera have the labrum of the first form very different from that of *Phyllocnistis*.

[Fig. 130]



Labrum of first form of trophi in *Ornix prunivorella* (after Chambers).

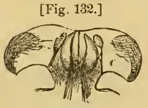
Fig. 129 represents the labrum of *Ornix inusitatumella* Cham.; Fig. 130 that of *O. prunivorella;* Fig. 131 that of *Gracilaria robiniella* Clem. The differences in form of the several organs of the trophi of the first form are greatest in the labrum; it assumes a greater variety of form than either the mandibles or labium.

[Fig. 131.]

Labrum of *Gracilaria robiniella* (after Chambers).

Fig. 132 is the labrum of *Phyllocnistis vitifoliella* Cham., and will answer for that of *Coriscium albanotella*; Fig. 136, *Lithocolletis ornatella*; Fig. 133, *Leucanthiza amphicarpeæfoliella* Clem.; Fig. 134, *L. guttifinitella*, and Fig. 135, *L. robiniella*. Fig. 138* is the mandible of *Lithocolletis guttifinitella*, but is typical of the first form of trophi of all of the genera above named except *Coriscium* and *Phyllocnistis*, which are represented at Fig. 137 (*Phyllocnistis vitifoliella*).

[Fig. 132.]



Labrum of first form in *Phyllocnistis vitifoliella* (after Chambers).

Fig. 141 is the labium of the first form in *Phyllocnistis;* Fig. 142 that of *Lithocolletis guttifinitella*, but will answer sufficiently well for any species of the flat or *ornatella* groups; while Fig. 139 represents that of *L. robiniella* of the cylindrical group, and Fig. 140 that of *Leucanthiza amphicarpeæfoliella*. In *Lithocolletis* and *Leucanthiza* the labium consists of an upper and lower lobe; in *Phyllocnistis* it consists of a single lobe.

[Fig. 133.]

Labrum of first form in *Leucanthiza amphicarpeæfoliella* (after Chambers).

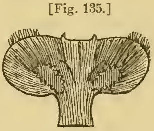
Fig. 143 is the labium of *Ornix prunivorella* Cham. That of *inusitatumella* is similar to it, but has the lateral tines shorter. There appears to be considerable variation within the limits of each genus in the form of the labrum, but little in that of the labium, and still less in the mandibles.

[Fig. 134.]

Labrum of first form in *Lithocolletis guttifinitella* (after Chambers).

But the labrum and labium in each genus differ somewhat from those of the other genera, though the labrum of *Phyllocnistis* is not very different from that of *Lithocolletis* and *Leucanthiza*. The trophi of *Leucanthiza* do not differ essentially from those of *Lithocolletis*. The labium in *Gracilaria* (Fig. 144) and in *Ornix* is very similar to that of *Phyllocnistis*, whilst the labrum differs decidedly from that of all the other genera; whilst *Coriscium*, closely related to *Gracilaria* and *Ornix*, has all of its trophi of the first form scarcely distinguishable from those of *Phyllocnistis*.

[Fig. 135.]



Labrum of first form in *Lithocolletis robiniella* (after Chambers).

Lithocolletis, *Leucanthiza*, *Gracilaria* and *Ornix* have mandibles alike (Fig. 138), and very different from those of *Coriscium* and *Phyllocnistis* (Fig. 137). On the theory of evolution, *Phyllocnistis* would appear to be the earliest or most elementary form from which the others may have been derived. But, as presently shown, it is at least as probable that all are degraded from a higher form or forms, and not evolved

[Fig. 136.]

Labrum of *Lithocolletis ornatella* (after Chambers).

* Fig. 138, the electrotype of which has been accidentally mislaid, will be given in the next number.

from a lower or *Phyllocnistis*-like form.

The first form of trophi seems to be correlated with membraneous legs. At least in every instance where the first form is found, the legs are membraneous and retractile. And when the trophi are changed, and the second or ordinary form assumed, usually at the same molt, the thoracic legs become jointed and armed with a claw, and the ventral legs are armed with the circle of tentacles. But these rules are not universal, for *Phyllocnistis* and *Lithocolletis of the flat group* never acquire the jointed legs, claw or tentacles, even when they acquire the second form of trophi. So, too, there are many larvæ of other genera, which, if they ever have trophi of the first form, must possess them whilst in the egg, for they leave it with trophi of the second form ; and though usually (in all (?) macro and most micro) lepidoptera, jointed legs, with claw and tentacles are associated with the second form of trophi, yet there are many genera of *Micro-lepidoptera* which, with the second form of trophi, are either apodal or have membraneous legs without claw or tentacles. Thus, *Aspidisca* has sucker-like discs in place of the thoracic legs, and no ventral legs; *Antispila* is apodal; *Nepticula* has a surplus number of membraneous legs ; while all of them have trophi of the second form from the time they are hatched. *Tischeria*, some *Gelechia*, and some other leaf-mining larvæ, on the other hand, leave the egg fully developed caterpillars, with trophi of the second form (Fig. 124), articulated thoracic legs armed with a claw, and ventral legs armed with a circlet of tentacles.

All of the genera above mentioned have leaf-mining larvæ.* *Usually*, soon after the articulated legs are developed, they leave the mine and either feed or pupate externally. The change is usually preparatory to leaving the mine. But some of them, as the flat and cylindrical groups of *Lithocolletis*, some species of *Gracilaria* do not leave the mine even after the change; though most *Gracilaria*, even when they continue to be leaf-miners, leave one mine and make another. Some, however, as *Gracilaria erigeronella* Cham., and all *Lithocolletis* of the flat and cylindrical group, never leave the mine at all. On the other hand, *Nepticula*, with its membraneous feet, *Antispila*, footless, and *Aspidisca*, with suckers in place of feet, leave their mines to pupate, and *Nepticula* has even been known to leave one mine to form another. *Phyllocnistis* never leaves the mine until the imago.

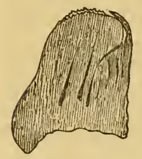
Can it then be said that these various structures are the result of conditions of existence or adaptability? All are leaf-miners, subject, as their ancestors have been for ages, to the same conditions of life within the mines. Usually, preparatory to leaving the mine, and before leaving it, a change takes place which fits them for different conditions and a different mode of life; but, as above stated, many even then remain in the same conditions. In many of them (*Phyllocnistis* and the flat group of *Lithocolletis* e. g.) the articulated legs are not acquired until the insect passes into the pupa state, which is wholly one of preparation, and in which apparently they have no use for any legs; and these same species, though they acquire the second form of trophi, have no use for any of its organs except the spinneret ; others, after acquiring the second form of trophi, use them for feeding in the mine, while a still greater number use them for feeding outside of the mine. What figure does the theory of the origin of organs, by adaptability to conditions of existence, cut in all this jumble?

How shall we account for these facts by any theory of evolution? There is of course a clear process of evolution in the history of each individual. There is the first form of trophi with membraneous legs; then follow the second form of trophi, usually accompanied by articulated legs; then follow the trophi of the pupa and imago, always with articulated legs. Then, in another set of larvæ we never find the first form, but we find the second form of trophi when the larva leaves the egg, and usually

* This is only true as to *Gelechia* in part; the greater number of *Gelechia* larvæ are not leaf-miners.

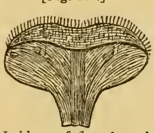
we see it accompanied by articulated legs—always so in the pupa state. There seems to be a regular ascending scale of evolution epitomized, for instance, in *Lithocolletis*. The fact that the articulated legs always succeed the membraneous ones; that what I have called the second form of trophi always succeeds the first, and is succeeded by that of the pupa and imago, seems to indicate that the organs which characterize the later forms have been acquired later in the evolution of the species than those which characterize the first form. But if this be so, then the earliest form of insect must have been, if not like the larva of *Phyllocnistis*, yet much more vermiform than it is supposed to have been by many entomologists. By the earliest form of insect we can, on a theory of evolution of all organic forms from one or a few elementary ones, of course, only mean some stage at which evolution was arrested or became stationary so long that the characters of that stage were impressed on all of its descendants. Whether there ever was such a stage, what caused the arrest at that stage, how long it lasted, and why there were so few such stationary stages as are indicated in the articulate sub-kingdom, are matters that we do not now inquire into. If there ever was such original insect form, it must have possessed all of the organs that are common to the insect class—its descendants. It must have been a typical insect. It must have possessed labrum, mandibles, maxillæ, maxillary palpi, labium, labial palpi, antennæ, eyes, articulated legs, and wings or their originals (branchiæ?). If so, then all larvæ must be degraded forms in so far as any of these organs are wanting; and larvæ with membraneous legs and trophi of the first form must be greatly degraded. We can imagine a process of degradation from this typical insect to such a larva as that of *Phyllocnistis*. Sir John Lubbock supposes the original insect form to have been something like *Campodea*, with mouth parts of a somewhat rudimentary character, capable of producing by evolution either the mandibulate or haustellate type. When we see how readily even the most decidedly mandibulate larvæ are metamorphosed simply by the rapid growth of some organs, and the absorption of others into haustellate butterflies and moths, it seems unnecessary to resort to an original form with equivocal or undeveloped trophi. It seems more probable that the original form of insect had all of the mouth parts well developed.

[Fig. 137.]



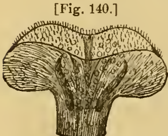
Mandible of *Phyllocnistis* (after Chambers).

[Fig. 139.]



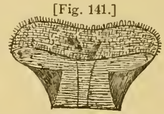
Labium of first form in *Lithocolletis robiniella* (after Chambers).

[Fig. 140.]



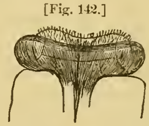
Labium of first form in *Leucanthiza amphicarpeæfoliella* (after Chambers).

[Fig. 141.]



Labium of first form in *Phyllocnistis vitifoliella* (after Chambers).

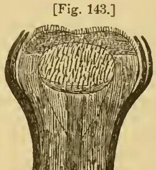
[Fig. 142.]



Labium of first form in *Lithocolletis guttifinitella* (after Chambers).

But if this be so, how are we to account for the diverse facts presented to us by the leaf-mining larvæ? So far, at least, as living in a mine and feeding on the parenchyma are concerned, the conditions of existence have been the same, no doubt, for ages; but how various has been the course of development. Upon what different variations natural selection must have seized, and with what different results and how singular that the right variation to produce the required result should have happened just at the right time, and in so many cases at the same time! Thus, the original larval insect, in order to become *Phyllocnistis*, must have lost its maxillæ, and its palpi; have had the form of its

[Fig. 143.]



Labium of first form in *Ornix prunivorella* (after Chambers).

labrum and labium greatly modified, and must have lost all trace of its legs and wings; then it must have evolved its lateral, membraneous, retractile legs in a different part of its body from that in which the legs of insects are found, though at corresponding places on each segment after the fourth; then, in its second stage, it must have had all of its trophi except the spinneret reduced to a minimum, and then in passing into the pupa state it again ascends by losing the membraneous retractile legs, and developing the jointed ones again in their proper place, together with wings, maxillæ and labial palpi, while the labrum, labium and mandibles remain degraded.

[Fig. 144.]

Labium in *Gracilaria robiniella* (after Chambers).

There must have been, first, a process of degradation whereby the insect lost most of its organs and acquired some new ones; and then again a process of elevation, whereby it lost its new organs and had its old ones again restored to it in an improved condition, except some of the trophi. In *Lithocolletis* and *Leucanthiza* the process of degradation did not go far enough to supply any new limbs. It simply deprived the insect of its palpi and maxillæ and converted its articulated legs into membraneous ones; and then again, while still in the mine, and subject to the same conditions, re-elevated it by restoring its maxillæ and palpi at the fifth molt in two of the groups, and at the third in another; and by restoring its jointed legs at the third molt in one group, and at the fifth and seventh, respectively, in the others. The same course is followed in *Coriscium*, *Ornix* and *Gracilaria*, except that the degraded condition only lasts through the first stage; and in the second, and while still subject to the same conditions in some cases, but preparatory to a change of mode of life in others, the larva is restored to the supposed original form. In such genera as *Nepticula*, *Aspidisca*, *Antispila*, *Gelechia*, etc., the process of degradation has not progressed so far. The larvæ have the second form of trophi when they leave the egg, and also jointed legs, or, at most, have only replaced the articulated legs by membraneous ones, or by none at all, and the articulated legs are restored again at or before pupation.

But has any such process of degradation and re-elevation really occurred? I do not undertake to say that it has. We have in science, especially in Biology, too much positive assertion as to matters which are purely speculative in their character. But if all insects are derived from an original form, and if that form was like *Campodea*, or, as is probable, had even more pronounced trophi, then such a process of degradation and re-elevation as I have indicated must have taken place. If, however, the original insect form was more vermiform than *Campodea*—more like the larva of *Phyllocnistis*—then the process of evolution has simply been one of elevation alone, and not at all of degradation so far as these genera are concerned. But in either event it seems difficult to account for the varied evolution of these different species while subjected to identical conditions of existence, by either natural selection or adaptation to conditions, without at least a Guiding Intelligence of some kind.

THE "MAGGOT" OF THE RICE FIELDS.

BY JOHN SCREVEN, SAVANNAH, GA.

This insect is found in the rice fields of the South cultivated with water. In general, these fields, whether supplied with water from tidal streams or from "backed-water" reservoirs, may be inundated or drained at pleasure. They are drained from $2\frac{1}{2}$ to 4 feet in depth, are usually firm under the tread of the horse, and may therefore be cultivated with all the mechanical appliances of agriculture. Of these the horse-rake alone has not yet been adapted to the peculiar requirements of the rice harvest.

While the fields are thus thoroughly drained, the rice plant, in the main aquatic

in its habits, demands deep and protracted irrigations during certain periods of its growth. Hence the fields, which are generally very level, are sometimes entirely submerged. It may be stated of a crop sown in March 1880, that of the 164 days between spring and harvest, the fields were inundated partially or entirely during 112 days, and were kept dry during 52 days.

The following were the periods of inundation and dryness:

OF INUNDATION:		
March 8 to 12,	4 days	
" 20 to April 24,	35 "	
June 8 to August 20,	73 "	
	—	112
OF DRYNESS:		
March 12 to March 24,	8 days	
April 24 to June 8,	44 "	
	—	52
Total crop days,		164

It will be observed from this statement that the fields were dry between the 24th of April and the 8th of June. During this interval they are commonly hoed twice and weeded before the succeeding inundation, called the "Harvest Flow," is applied. Thus the soil is thoroughly stirred while dry, except immediately under the plants.

When the "Harvest Flow" is applied, it remains until the grain is ready for the harvest (hence the term "Harvest Flow"), except to be occasionally discharged and immediately renewed, according to the judgment of the planter. As the water of this flow is over the land in the hot months, and as water at rest partakes very closely of the temperature of the air, it presents the characteristics favorable to putrescence, if allowed to remain unchanged, especially when lying over mold land.

On the 13th of July the "maggot" was found in fields which had been put under the Harvest Flow on the 18th of June. During this period the fields had been twice emptied and fresh water supplied. Indeed, this had been done only a few days before the insects were found.

These were discovered in their usual primary habitats—in the lowest parts of the fields, where the water was deepest, and where the soil shows most mold. The fields were immediately emptied, kept drained from two to four days, and the water then restored. After this the worm disappeared, and the plant, which had betrayed their presence by dying leaves and defective growth, regained its vigor.

In this instance there was no putridity in the soil or water when the maggot was found; but commonly, offensive soil and water accompany its presence. Hence it has become *a question among rice planters, whether the little worm called "maggot" is properly a maggot of, or peculiar to, putrescence, or a predatory worm bred in the water on the fields, regardless of its purity.*

The depredations of the maggot are always damaging to the crop in more or less degree, especially as they affect during the period of gestation, when the plant demands the fullest use of its feeding organs. Sometimes these depredations cause great losses. Hence, if it is ascertained that the worm is generated by putrescent conditions in the water, the preventive method of treating the fields is, obviously, the certain remedy for the evil.

It is now too late to furnish a plant showing how and where the maggot attacks; but it may be enough to state that they assail and destroy the succulent roots of the plant, and so incapacitate it for obtaining food.

NEW METHODS OF FIGHTING CERTAIN INJURIOUS INSECTS.

BY PROF. A. J. COOK,* LANSING, MICH.

It is well known that there is no worse pest to the pomologist than the Codling Moth, (*Carpocapsa pomonella*, Linn.). The great mischief done by this pest is augmented from the fact that the best preventive hitherto known has been effective only after the insect had done its evil work. We have known no way to destroy the moths, but could only capture and destroy the larvæ after the apples were eaten. Last winter I learned from Mr. J. S. Woodward, of Lockport, N. Y., that trees thoroughly syringed with Paris Green, about the 20th of May, bore apples which were wholly

* Read before the Association for the Advancement of Science, at the Boston Meeting.

exempt from the ravages of the Apple-worm. Acting upon this suggestion, I thoroughly sprayed some Siberian crab-apple trees the 25th of May, and again the 20th of June; but I used London Purple, one tablespoonful to two gallons of water. The fruit of these trees has been seriously injured whenever they have borne during previous years. This year they were loaded with fruit, but careful examination, made August 19th, discovered not a single injured apple. A few showed signs of the previous work of the larvæ; but as no burrow extended for more than one-fourth of an inch, no harm was done. Other apple trees, only a few rods distant, which were not treated with the poisonous liquid, are bearing fruit, one-fourth to one-half of which is "wormy."

From the very small amount of the poison applied to each tree, not more than one-third of an ounce, the cost of the remedy is very light. For the same reason, as also the early application of the poison when the fruit is yet immature, and is sure to be washed by frequent rains before it is gathered, we should expect no danger from use of the London Purple. But to make assurance doubly sure, I cut from a portion of the apples on a part of a tree where the poison was applied in such excess as to destroy the foliage, one hundred of the blossoms, the portion where the poison would be most sure to lodge, and submitted them to Dr. Kedzie for analysis. Not a trace of the poison was found. If future experience sustains the conclusions as to the efficiency of this remedy, it will be a very important discovery.

Previous to the present time, there has been no satisfactory method known of fighting such pests as the Cabbage Maggot, (*Anthomyia brassicæ* Bouché,) and other insects of the same genus, and the Squash-borer (*Melittia cucurbitæ*, Harr.). The late Dr. Walsh recommended hot water, but this has proved only partially successful. During the present season my pupil, Mr. Chas. McKenny, and myself, have tried bisulphide of carbon, with the happiest results. I was led to try this from its excellence in destroying museum pests, and the success which has attended its use in Europe in destroying the Grape Phylloxera. To apply it, a small hole is made in the earth near the main root of the plant, by use of a walking-stick or other rod, and about one-half a teaspoonful of the liquid poured in, when the hole is quickly filled with earth, which is pressed down by the foot. In every case the insects were killed, without injury to the plants. I believe this substance promises most satisfactory results in fighting the above-mentioned insects, the peach-borers, and other insects that attack the roots of our cultivated plants.

We must remember that this liquid is very volatile, and the vapor very explosive.

A NEW LEAF-CUTTING ANT IN NEW JERSEY.

BY REV. G. K. MORRIS, VINELAND, N. J.

At Island Heights, a new summer resort on Barnegat Bay, N. J., I have found a new leaf-cutting ant. That it belongs to the *Attidæ*, is the opinion of both Dr. McCook and Mrs. Treat. It has the rugosity on the head which characterizes Dr. McCook's Texas cutting-ant, and resembles it in so many other particulars as to leave no doubt of their relationship generically. This, however, is much smaller, being not much more than an eighth of an inch in length. Like other leaf-cutters it carries its burden on the top of its head, and along the back. A row of them marching in single file, each carrying a piece of the fine needle-like leaf of tender pine seedlings, suggests a file of soldiers armed with rifles. It is an amusing sight, and provokes a smile. Sometimes the leaf carried is twice as long as the ant. I have seen them gathering only one other leaf besides the young pine-leaf, viz: from cow-wheat (*Melampyrum americanum*). Of this plant they gather also the petals. They make relatively very large cells, of the general shape of a coffee-cup, and from two to four inches in diameter. The nests examined were in fine white sand, but the cell walls were made very firm and smooth. In sev-

eral instances the walls were lined with what may be called a curtain of sand, of different color, the particles of which are held together mysteriously, and the whole suspended against the walls of the cell. This curtain is readily removed, leaving the hard, smooth wall with its original finish, showing clearly that after the formation of the chamber and the completion of the walls, the yellow sand had been brought up from a lower stratum, from two to three feet down, and worked into a loose drapery of hitherto unheard of texture. Dr. McCook assures me that after the pupa state, ants cannot make web. It may be in a sense true, but certainly these ants use a fine, white filament, for which I know no other name than web.

The leaf-cuttings are manufactured into a porous, spongy material, which becomes crisp when exposed to the air, and in which the young ants are reared. I have usually found this material either on the bottom of the cell or chamber, or else filling the same loosely from top to bottom. I was not prepared, therefore, for what met my eyes in the last chamber examined. Cutting away the side cautiously, I gained a view that surprised me beyond expression. I could have doubted my own eyes, if such a thing were possible. The material described above, made of leaves and other matter, was suspended from the roof of a cell three and a half inches high and wide, extending nearly to the pebble-covered floor. The arrangement was like that of the comb in a bee-hive. There were three combs, or layers, each shorter than that by its side. These were full of small, irregular pockets, so made as to take advantage of all the material used, but not evenly arranged side by side. Each pocket had been completed by itself, and without reference to those about it. They were designed for the young ants, but in this case were empty. I am persuaded that this comb, if I may so call it, is made of the partially masticated cuttings bound together with web-like filaments. Washing a little of it in alcohol and placing it under the glass, I distinctly saw white-web completely covering some of the particles. The arrangement of the delicate architecture was disturbed in the attempt to remove it, and still further in the transit home. Still, it is in fair condition for study, and, being under glass, does not change.

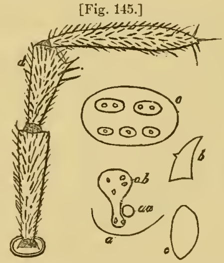
P. S.—The harvesting ants reported in last ENTOMOLOGIST are species of *Pheidole*. The larger one is pronounced by Forel a new variety of *P. pensylvanica*, the smaller is *P. megacephala*.

BIOLOGICAL STUDIES ON SILPHA RAMOSA.

BY CARL F. GISSLER, BROOKLYN, N. Y.

In May, '79, I received from Drum-major E. Scheller, Fort Vancouver, Washington Territory, a box containing three specimens of *Calosoma tepidum* and a live pair of *Silpha ramosa*. Having disposed of the former, I kept the latter in order to raise the larvæ.

[Fig. 145.]



SILPHA RAMOSA.—*a*, ophthalmic region; *a a*, antennal ring; *a b*, pigment spots (ocelli); *b*, small maxillary process on mando; *c*, olfactory disc on second antennal joint; *d*, antenna, enlarged; *e*, usual form of egg, enlarged (after Gissler).

As I am not aware that biographical notes have ever been published on this Coleopteron, the following will be of interest to entomologists.

Imago. The female is recognized by its broader pygidium beset with very short stiff bristles and a transverse elevation indicating an eighth connate segment; the pygidium of ♂ is narrower, tips of genital "armature" constantly sticking out, which is also beset with long, stiff bristles. The pygidium of the ♀ is always curved toward the abdomen.

They copulate every few hours, the ♂ constantly pursues and annoys the ♀, often snapping at the latter and biting into

tips of elytra, for which reason these (in collections) are so often found lacerated. The ♀ is often found burrowed into the soil to escape the carressings of the ♂, and also for oviposition which takes place there.

The *eggs* are very large in comparison with the size of this insect. They measure from $2^{25\,mm}$ to $2^{50\,mm}$ in length and about 2^{mm} in width; therefore nearly orbicular, but, when hastily deposited by specimens kept in captivity for some time, they are ellipsoid-oval and much smaller. The chorion is perfectly structureless. In crushing one of the eggs, having no visible primitive discs, the microscope revealed *large, shining, white, and flat, non-nucleated discs.* I regard them as peripheric yolk-granules formed shortly before the formation of the blastodermic skin (amnion). The greater part of these discs or corpuscles are of spherical shape, others are more elongate, and even some are of a more irregular form, varying also in size. Acetic acid rapidly dissolves them.

The eggs are of a yellowish-white waxy appearance, many of them exhibiting the "primitive disc" or "blastodermic skin" through the semi-transparent chorion.

In the evening of the day on which I received the insects by mail (May 24th, '79) I found eight eggs in the breeding jar. In the morning of May 30th I found three larvæ of a black and two of a light pink color on the sand in the jar. The remaining three eggs hatched the following day.

Larva.—Length (exclusive of proleg and pygidial appendages) of the freshly hatch-larva 6^{mm} (!), width of metathorax $2, 8^{mm.}$ Three days after hatching (June 1st) the oldest larvæ cast their skin. The freshly molted larvæ are considerably larger and of a pinkish color, within *twelve minutes* passing through an iron-grey into the above-mentioned bluish-black color.

On the evening of June 2d the largest larva measured $17^{mm.}$ Newly hatched larvæ walk slowly and by jerks, while older ones run very fast and with more intelligence. In casting off the skin, the larva breaks only the occiput of the head and squeezes itself through a median cleavage of the three thoracic dorsal segments. On June 3d at half-past seven P. M., a second exuviation took place. These larger larvæ are (21^{mm} long, metathorax 6^{mm} wide) extremely sensitive to light, for, on approaching a lighted match in the evening, all the larvæ immediately cover the lower ocelli (Fig. 143, *a*) with the tibiæ of the anterior legs, bending also the head downward.

The freshly exuviated larvæ most plainly show the 6 ocelli on each side of the head (Fig. 143, *a*). A dark pigment-zone is formed around the upper ocelli, after the first half-hour of casting the skin, extending downward and around the lower ocelli. The tips of the oral parts also blacken at this time. The larvæ are unusually voracious, but remain quiet before casting. They remain so also for some time after casting. On approaching the side of the head of a larva with a glass-rod that has been dipped in some ethereal oil, *they suddenly turn and walk away.* This has even been noticed in larvæ just before casting, at a time when they always remain quiet on some spot on the sand. The disc near tip of second antennal joint I therefore take for an *olfactory organ** in these carrion-larvæ (Fig. 143, *c*). A third exuviation took place on June 11th, but, curiously enough, in all cases the larvæ broke through the *sternal* part of the thoracic segments. Shortly before and after the third molt, the larvæ were found digging into the sand, only coming out for a short time in quest of food. Five days after the last molt all my larvæ died.

Description of larval parts.—*Labrum* incised at middle, densely covered with short, stiff bristles. Mandibles without molars. Mando of maxilla with a superior outer series of twelve short, non-articulated processes (Fig. 143, *b*), the same occurring also on an inner inferior series together with ten longer articulated spines. Tip of mando with a smaller penicillus of bristles and a larger penicillus near the outer margin of mando.

Maxillary palpus, three-jointed, first joint truncate-elongate, second joint club-shaped, last joints lightly swelled a little behind middle, tip acute, conical with an areola of "sensitive aciculi." Joints one and two equal, third joint one-third longer. *Labial palpus*, two-jointed, first

* I could never notice such a delicate sensibility toward odors in other hexapodous larvæ possessing sensitive aciculi or papillæ on tips of maxillary or labial palpi.

joint clubbed, second conical, tip with "sensitive aciculi." Both joints equally long. *Mentum* fleshy, narrow at base, broadening toward the rounded tip. Apparently no *ligula*. *Head* small, yellowish with a small aspersion of black pigment on occiput.

The body-*integument* exhibits under the microscope a beautifully arranged black pigmentation with fine canals between them. *Legs*, the middle and posterior pairs slightly longer than the anterior. The coxal supports are prominent, coxæ short, trochanter very short and apparently connate with the former, but the cast-off skin plainly shows a ring of the former going over one of the latter, thus lacking the internode of the other articulations; femur and tibia with long thick bristles, both pieces compressed, the latter slightly shorter than the former; claw simple and with two spines at middle.

Prothorax gradually getting broader toward base, as long as two of any of the other segments together, an impression along the margin, the anterior transverse line of which reaches the middle of the segment.

Mesothorax a little wider than the preceding.

Metathorax, the widest of all the body-segments. About four times wider than long.

The abdominal segments gradually diminish in width toward pygidium. The three thoracic segments and the first eight abdominal segments with a short bristle at base of marginal scute and one such bristle at tip, the latter bent back and downward. Ninth dorsal segment at tip with a cylindrical, immovable spine of the length of any of the terzal scutes. *Spiracles*, nine pair; first and largest near base of prothorax a little behind and above the anterior coxa. Second to inclusive fifth spiracle in the pleurites anteriorly of each of the first five abdominal segments, the last three spiracles are much smaller and correspond with the sixth, seventh and eighth segments; ninth segment without spiracle.

First ventral abdominal segment and sternal region remain whitish with a slight darker aspersion between the coxæ. Tenth ventral segment prominent (anus), cylindrical, serving as a propeller, fimbriate around the margin.

Antennæ. Cylindrical, three-jointed. First joint narrow, conical at base, second slightly shorter than the preceding; near tip, interiorly with an "*olfactory disc*," consisting of two anterior larger and three posterior smaller areolæ. Third joint inserted into a fleshy, transparent, retractile internode, base of third joint very narrow, getting thicker and thickest a little behind middle, tip conical. Second and third joints with stronger bristles than first joint. Third joint bent *inwardly*.

The olfactory disc can be better seen in the exuviæ than in the living animal.

POTATO BUGS.—Last Monday there was such a swarm of potato bugs on the rails of the Connecticut River Railroad between South Ferry and Holyoke, Mass., that it was with difficulty the locomotive could draw the train through them. The crushed insects made the rails very slippery, causing the wheels of the engine to slide.—*Evening Star*, Washington, Sept. 13.

ON THE RED OR CIRCULAR SCALE OF THE ORANGE (Chrysomphalus ficus Riley MS.).

BY WM. H. ASHMEAD, JACKSONVILLE, FLA.

BIBLIOGRAPHICAL.

Chrysomphalus ficus Riley. Manuscript notes.
" " " Ashmead, *Fla. Agriculturist*, 1879.
" " " Ashmead, *Pacific Rural Press*, 1880.

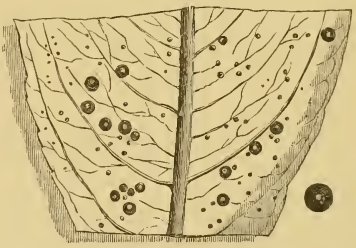
ITS FIRST APPEARANCE IN FLORIDA.

In September, 1879, I received the following communication, with specimens of infested leaves, from Mr. G. M. Holmes:

ORLANDO, Orange Co., Fla., Sept. 20, 1880.

Dear Sir:—Inclosed I hand you a leaf of an orange-tree infested with what appears to be a species of scale insect, which is new to us down here. It spreads from tree to tree very rapidly, and is not confined to the leaf, but appears upon tender stems and thorns. As you can see, it turns the leaf yellow wherever it locates itself.

[Fig. 146.]



Portion of Orange Leaf infested with *Chrysomphalus ficus* (after Ashmead).

I should like to know whether it is an enemy much to be dreaded, and, if you have had experience with it, the cure. Although a stranger to you, I see by the *Florida Agriculturist* that you have made the insects on orange-trees a study, and I thought you might give me some information about this particular insect. Yours, respectfully,—G. M. Holmes.

The scale being new to me, I immediately forwarded specimens to Prof. C. V. Riley, and from his reply I quote the following: "The circular, dark-brown scale with a golden centre has long been in my cabinet, and I have found it quite injurious to *Ficus nitida*. I have designated it by the manuscript name *Chrysomphalus ficus*, but have published no description of it, as the mere description of the scale without fully characterizing the insect that makes it, in both sexes, is imperfect entomological work."

ITS IMPORTATION AND SPREAD.

In Los Angeles, San Jose, California, and, indeed, in various parts of the State, it is quite numerous on the Orange, and is there known as the "Red Scale." The orange tree has but lately been introduced and grown in California, and this particular species is, therefore, not indigenous there. Where, therefore, did it come from, and how was it introduced into the State? These are two very important questions. Now, the commercial relations existing between the Californians with the people of China, Japan and Australia, point to one of these countries as its original home or starting point, from which it has spread. Indeed, many oranges have been imported from all these places, and it would not be surprising to me if, like our own *Long Scale* (*Aspidiotus Gloverii*), the Red Scale had been imported in the same manner, *i. e.*, on the leaves, branches or twigs of an imported tree. It has evidently been introduced into Florida this way.

ITS FOOD-PLANT.

Prof. Riley states that he first found it on the *Ficus nitida;* this, I presume, is an exotic species of Fig. I see by the *Pacific Rural Press*, that this, or an allied species, had been found on the Apple trees in San Jose, Cal. With the Orange, it attacks the fruit, leaves and twigs, seeming to like one about as well as another.

ITS NATURAL HISTORY.

I have not been able to thoroughly work up this insect, for want of specimens. From specimens received at different times, there would seem to be at least three broods, if not more, during the year. The first brood probably hatches in May; the second, from last of July to second week in August; and the third, from last of September to first week in October.

DESCRIPTIVE.

Eggs.—From 18 to 30 under each scale, less than .01 of an inch in length, ovoid, smooth, not quite twice as long as broad, of a bright yellow, promiscuously inclosed in body-walls of dead female.

Larva.—Length of body less than .01 of an inch, nearly twice as long as wide, *bright* yellow, ovoid, much wider towards head, being widest at thoracic segments; two very short anal setæ, hinder margin rough from numerous small fleshy tubercles, with a few short hairs around margin, no indentations as in *Ceroplastes rusci;* antennæ, 6-jointed (not easily made out with my microscope, which is of a low power); basal joint short and stout, nearly as wide as long; joints 2 and 3 less wide and of equal size; joints 4 and 5 about equal, each longer and thicker than 2 and 3 together; joint 6 much thinner, ending at tip in 2 long hairs, the inner being longest; an inner and outer hair on basal joint, with two inner and two outer ones on joints above these; legs ending in a feeble claw and four digituli, the two upper being longest; femora thickly swollen, with a distinct lobe near base, from which a sharp spine issues. I have never noticed this in any other scale insect.

Female Scale.—Form, round or circular, flattened slightly, rising towards centre, of from a reddish to a blackish-brown color, paler at margin, measuring from .04 to .12 of an inch in diameter; in the centre is a slight depression, in larger specimens .02 to .03 of an inch in diameter, and of a bright golden yellow, with a small brown cap.

REMEDY.

Mr. Holmes writes me, under date of August 6th, as follows: "As you request, I forward you by this mail a box containing specimens of the *Chrysomphalus ficus*, which I hope may reach you in good order. They have not done me any material damage as yet, but I keep my trees in very healthy condition and thrifty growth, as I have a large drove of cattle, and can cowpen them. In my experiments for their removal, I have been most successful in the use of a strong brine of salt and water applied twice, at intervals of two weeks. It is heroic treatment and takes the leaves off, but the scale comes with them, and, if done just prior to a growing season, they soon send out a luxuriant new growth and

seem more healthy than before. I think if potash was mixed with salt and water it would be an improvement, and am going to use it that way. You have my best wishes for the success of your book on orange insects, which will supply a want or need long felt by intelligent orange-growers."

THE USE OF FUNGUS GROWTHS TO DESTROY INSECTS.

In the "American Naturalist" for August and September of the present year Prof. A. N. Prentiss of Cornell University, has an interesting contribution to the above-named subject. After reviewing the observations made by previous writers Prof. Prentiss makes the following remarks on the normal presence of fungus spores:

"In examining the question as proposed by Dr. Hagen, many facts must be taken into account before deciding upon the probable results. It must be remembered that the air is at all times charged with the spores of fungi. Dr. Cunningham found that 'spores and other vegetable cells are constantly present in atmospheric dust, and usually occur in considerable numbers; the majority of them are living and capable of growth and development.'"*

"Dr. S. M. Babcock, who is determining the chemical changes of cheese during the curing process, finds it impossible to avoid mold in the curd except by heat and anæsthetics (ether and chloroform). He states that the spores *seem* to be in the very milk used in the experiments.

"In the Botanical Laboratory, where molds and yeast are cultivated at certain times for experimentation, the air soon becomes charged with spores.

"Growing in the same laboratory and rooms directly connected with it, are plants which require constant care lest they be overrun with their several insect pests. No disease appears to have attacked these insects. It may be that they do not feed upon the yeast, and for this reason escape. It is not necessary that the spores be eaten by the insect in the case of the fly fungus (*Empusa muscæ*). Huxley says:* "It has been ascertained that when one of the spores falls on the body of a fly, it begins to germinate and sends out a process which bores its way through the fly's skin; this having reached the interior cavity of the body, gives off the minute floating corpuscles which are the earliest stages of Empusa. The disease is 'contagious,' because a healthy fly coming in contact with a diseased one from which the spore-bearing filaments protrude, is pretty sure to carry off a spore or two. It is 'infectious,' because the pores become scattered about all sorts of matter in the neighborhood of the slain flies."

"In this connection it should be noted that while the insects which infest more or less the plants growing in the laboratory have not been affected in any way by the fungi or their spores, the plants themselves, in some instances, have been seriously injured. On one occasion, recently, some experiments which had been commenced with much care upon *Drosera rotundifolia* were brought to a sudden end by a mold which completely overrun and destroyed the plant. That the air of the laboratory should become abundantly charged with spores, would, of course, be expected from the large number of experiments in the growth and propagation of microscopic fungi which at times are being conducted by the members of the classes in mycology. Indeed after a time the spores become so abundant that all apparatus has to become thoroughly cleansed and fumigation by sulphur resorted to in order that the experiments with the fungi themselves should not be defeated.

"The abundance of these spores of many kinds, including those of the house-fly fungus, emphasizes the fact that Aphides and other plant insects seem to thrive in the midst of these spores without any diminution of their vigor or power of reproduction."

A series of nine experiments in applying the yeast fungus to Aphides, as con-

* "Microscopical Examinations of Air," from the "Ninth Annual Report of the Sanitary Commissioner," Calcutta, 1872.

* "Lay Sermons, Addresses and Reviews," p. 372.

ducted in the Botanical Laboratory of Cornell University with the assistance of Mr. W. A. Henry, is recorded by Prof. Prentiss. All the experiments made in an ordinarily free atmosphere resulted in no harm to the insects; the others showed no ill results except where the insects were confined in an unnaturally moist atmosphere, as that of a Wardian case or bell glass—conditions which will kill and render moldy almost any insects without the application of yeast, but must be trebly fatal to delicate-skinned insects when these are, in addition, covered with any sticky substance. Two of the experiments showed that where mold appeared it was independent of the yeast application.

Prof. Prentiss further remarks: "The result of these experiments, as a whole, as also many others not here recorded which have a more or less direct bearing upon the subject under consideration, indicate plainly that yeast cannot be regarded as a reliable remedy against such insects as commonly affect plants cultivated in greenhouses, rooms and parlors. Moreover, it is more than probable that the yeast would injure many kinds of plants, especially those with delicate foliage, by spotting and soiling the leaves, and inducing fungoid growths upon the jars or soil in which the plants are grown. Indeed, in most greenhouses at the present time, it is not so much a question of keeping down injurious insects, as it is the suppression of molds and mildews of various kinds. The verbena rust only need be named as an illustration of this point."

FOOD HABITS OF THE LONGICORN BEETLES OR WOOD BORERS.

BY THE EDITOR.

(Continued from p. 239.)

LAMIIDÆ.

Monilema. The species of this genus are reported to feed on various species of Prickly Pear, and it might be inferred, therefore, that the larvæ live on the roots of these plants.

Psenocerus supernotatus (Say), is the "American Currant Borer" (Fitch, 3rd Rep., pp. 98–105); bores also in branches of Apple trees (Packard Guide, p. 500).

Monohammus titillator (Oliv.), boring in the bark of *Pinus sylvestris* at St. Louis, the perfect insect appearing May 21st (C. V. Riley).

Monohammus scuttellatus (Say), boring in pine wood in a similar manner to *M. confusor* (Fitch, 4th Rep., pp. 24–25).

Monohammus confusor Kirby, boring cylindrical holes in the interior of the wood of pine trees, chiefly of decaying and dead trees (Fitch, 48th Rep., pp. 21–24).

Dorcaschema wildii Uhler.

Dorcaschema alternatum (Say). These two species occur on Mulberry and Osage Orange, and the larvæ live, no doubt, in the roots of these plants (C. V. Riley).

Dorcaschema nigrum (Say), breeds in Hickory (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller).

Hetœmis cineria (Oliv.). On *Morus rubra* (Haldemann, Tr. Am. Phil. Soc., X, 54).

Goes tigrinus (De G.), greatly injuring Hickory trees by boring in the green wood (Fitch, 1st Rep., pp. 146–151; 3d Rep. pp, 120–121).

Goes pulcher (Hald.). "Scarce, but a few are found every season in the Shag-bark and Pignut hickory, June and July" (Dr. T. Hadge, Buffalo, N. Y., *teste* A. S. Fuller).

Goes pulverulentus (Hald.). "This insect is very destructive to living Beech trees. It bores into those branches which are about three inches in diameter. The length of the channel is about eight inches" (Dr. G. H. Horn, Proc. Ent. Soc., Phil. I., pp. 43–44.

Goes debilis Lec. "Very bad in trunks of Swamp Oak" (C. V. Riley); bores the Oak, especially unhealthy trees (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller); is no doubt a borer in the trunk of White Oak (Fitch, 5 Rep., p. 12).

Plectrodera scalator (Fabr.). Breeds in the Willow, especially the smaller species growing along the banks of streams in the Western States (C. V. Riley); bores in the roots and lower part of the trunk of Cottonwood trees in Texas (E. A. Schwarz).

Acanthoderes 4-gibbus (Say),* bores in dead twigs of Oak, Beech, Hackberry (Schwarz).

Leptostylus aculifer (Say). The larva bores into oaks and occasionally apple trees (A. E., I., p. 225); working under the bark of apple trees, making broad, irregular burrows, causing the bark to raise, discolor and die. Also reported from Tallahassee, Indian Territory, as boring in Osage Orange (C. V. Riley).

Leptostylus biustus (Lec.), bred from a dried up pomegranate (Tallahassee, Florida; C. V. Riley).

Leptostylus commixtus (Hald.), the larva probably having the same habits as *L. aculifer* (Fitch, 4th Rep., p. 26).

Leptostylus macula (Say), larva under the bark of old decaying Butternut trees (Fitch, 3d Rep., p. 144).

Sternidius alpha (Say), boring in dead apple twigs, the perfect insect issuing in May (C. V. Riley).

* The larva of the South American species, *Stirostoma depressum*, which we lately received from Param, Brazil, is reported to be very injurious to the Cocoanut tree by boring in the stem.

Sternidius xanthoxyli (Shimer), boring in dead wood of Prickly Ash (Shimer, Trans. Am. Ent. Soc. 1868, pp. 7–8).

Liopus crassulus (Lec.), boring in dead twigs of *Celtis texana* (E. A. Schwarz).

Liopus quercus Fitch. Fitch feels assured that it lives at the expense of the Red and White Oak (5 Rep., p. 16).

Hyperplatys aspersus (Say), boring in dry twigs of *Populus monilifera* at Columbus, Texas ; perfect insect to be found throughout spring and summer (Schwarz).

Hyperplatys maculatus (Hald.), "in apple twigs, Ithaca, N. Y." (Riley) ; in dry twigs of *Populus tremuloides*, Marquette, Mich. (Schwarz).

Urographis triangulifera (Hald.), boring under bark of *Celtis texana*, but only of trees already injured by other causes. Columbus, Texas (Schwarz).

Urographis fasciata (De G.), "feeding on and destroying the inner bark of the Black Oak, *Quercus tinctoria*, of newly-felled trees, forming large tracks therein, which are filled with worm dust," the perfect insect appearing in June (Fitch, 5th Rep., p. 14) ; from hickory stump (marginal note by B. D. W.); larva found in a rotten oak stump (C. V. Riley).

Acanthocinus nodosus (Fabr.), "found under the bark of Pine from June to September" (Bland, Proc. Ent. Soc. Phil. I., p. 97) ; larva mining under the bark of felled Yellow Pine, near Tampa, Fla., the perfect insect appearing in April (E. A. Schwarz).

Hoplosia nubila Lec. Larva boring in dry Beech twigs, Detroit, Mich. (E. A. Schwarz).

Eupogonius tomentosus Hald., larva mining the wood of the Pine ; imago appearing in July (Fitch, 4th Rep., p. 26); larva boring in tender twigs of felled Yellow Pine (E. A. Schwarz).

Eupogonius vestitus (Say), bred from Hickory (C. V. Riley).

Oncideres putator Thoms., girdling Mesquite twigs and larva boring in the twigs. From Arizona (C. V. Riley).

Oncideres cingulatus (Say). The "Twig-girdler" often referred to in the books. Its habits were first described by Haldeman (*Pennsylvania Farm Journal*, vol. I., p. 34, and Tr. Am. Phil., X., 52, 1847). Breeds in the Hickory, Apple and Pear tree.

Ataxia crypta (Say), boring in dry cotton stalks, Texas (Riley) ; boring in dry twigs of Box Elder and Hackberry, Columbus, Texas (E. A. Schwarz).

Hippopsis lemniscata (Fabr.), the perfect insect, together with full-grown larva, found in cane of *Ambrosia*, in June, in Missouri (C.V. Riley).

Saperda calcarata Say, the larvæ of this species "with those of the broad-necked *Prionus* have almost entirely destroyed the Lombardy Poplar in this vicinity. They live also in the trunks of our American Poplars" (Harris, p. 107) ; Am. Linden (H. G. Hubbard).

Saperda candida Fabr. The well-known Apple-tree borer. "The trees and shrubs principally attacked by this borer are the Apple tree, the Quince, Mountain Ash, Hawthorn and other thorn bushes, the June-berry or Shad Bush, and other kinds of *Amelanchier* and *Aronia*" (Harris, p. 108, followed by a full account of the habits of the larva) ; attacks not only the wild and cultivated Apple (*Pyrus*) but also the Thorn (*Cratægus*), the Mountain Ash (*Pyrus americana*), the common Quince (*Cydonia vulgaris*) and the ornamental sorts (*C. japonica*, etc.).

Saperda Fayi Bland, lives in the Hawthorn and appears to prefer the low growing bushes. The grubs cause the branches to become gnarled and covered with knot-like excrescences. June and July (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller) ; "Attacks the limbs and skin of the wild thorn (*Cratægus crus-galli* and *C. tomentosa*) creating a gall-like, gnarly swelling" (C. D. Zimmermann, Can. Entom. 1878, p. 220).

Saperda vestita Say, very injurious to the European linden in Cambridge, Mass. and Philadelphia, Pa. (Harris, p. 110) ; boring at the base of young European Linden and gouging two parellel rings around the trunk which form annular swellings (C. V. Riley).

Saperda discoidea Fabr., larva bores in Hickory in company with *Cyllene pictus* (C.V. Riley); boring in Hickory trunks (Fitch, 3d Rep., p.122).

Saperda tridentata Oliv., greatly injurious to Elm in Boston, Mass.; "Very rarely did they [the larvæ] seem to have penetrated far into the wood itself, but their operations were mostly confined to the inner layers of the bark, which thereby became loosened from the wood beneath" (Harris, pp. 112–113); "consuming the inner bark of the Slippery Elm (*Ulmus fulva*) in decaying and dead trees" (Fitch, 5th Rep., pp.59–60).

Saperda puncticallis Say, found on Poison Ivy, *Rhus toxicodendron* (C. D. Zimmermann, Can. Ent, 1878, p. 220).

Saperda lateralis Fabr., "mining the inner bark of dead trees and logs of the common Elm (Fitch, 5 Rep. pp. 60–61).

Saperda moesta Lec., bores the Poplar, selecting the smaller branches (Dr. F. Hadge, Buffalo, N. Y., *teste* A. S. Fuller).

Mecas inornata (Say), bores in the roots and lower part of the stems of *Helenium tenuifolium*, the perfect insect appearing from May till July (Columbus, Texas, E. A. Schwarz).

Oberea bimaculata (Oliv.) (*tripunctata*, Fabr.), the larva burrowing in the stems of the Blackberry and Raspberry (Harris, p, 114). Pupates in the root, beneath the surface of the ground.

Oberea schaumii (Lec.), larva boring in the twigs of Cotton wood making a very smooth cylindrical burrow, the perfect insect appearing in the middle of June. St. Louis, Mo (C. V. Riley).

Oberea mandarina (Fabr.), larva boring in the thin twigs of *Populus monitifera* at St. Louis, Mo., the imago issuing in the middle of April (C. V. Riley).

Tetraopes tetraophthalmus (Forst.), larva boring in the root and lower part of the stem of Milkweeds (*Asclepias*), upon which plants all the species of the genus are found (Schwarz ; Riley) ; larva in the soil near the roots of *Asclepias cornuta* (W. L. Devereaux, Can. Ent., 1878, p. 143).

Dysphaga tenuipes (Hald.), in dead limbs and twigs of Hickory, the beetle appearing in May (Fitch, 3 Rep., p. 123) ; in Carya twigs (Haldemann, Proc. Phil. Ac. Nat. Sc., 3, 126).

PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE ENTOMOLOGICAL CLUB OF THE A. A. A. S.

[The following minutes of this meeting were kindly furnished by the efficient Secretary of the Club, Mr. B. P. Mann. The papers themselves are omitted, as they have been, or will be, published in these columns or elsewhere.—Ed.]

The Seventh Annual Meeting was held, as announced, in the lecture room of the Boston Society of Natural History, at Boston, Mass., beginning on the 24th day of August, 1880. More than fifty persons were present, of whom the following are best known for their interest or work in entomology:

E. P. Austin, Boston.
H. F. Bassett, Waterbury.
C. J. S. Bethune, Port Hope.
F. Blanchard, Lowell.
F. C. Bowditch, Brookline.
E. Burgess, Boston.
T. J. Burrill, Champaign.
Cora H. Clarke, Boston.
A. J. Cook, Lansing.
C. R. Dodge, Washington.
J. H. Emerton, Salem.
C. H. Fernald, Orono.
C. Fish, Oldtown.
E. L. Graef, Brooklyn.
A. R. Grote, New York.
H. A. Hagen, Cambridge.
S. S. Haldeman, Chickies.
S. Henshaw, Boston.
H. Hinkley, "
P. R. Hoy, Racine.
J. L. LeConte, Philadelphia.
J. A. Lintner, Albany.
H. H. Lyman, Montreal.
G. Macloskie, Princeton.
H. C. McCook, Philadelphia.
B. P. Mann, Cambridge.
E. L. Mark, "
D. S. Martin, New York.
C. S. Minot, Boston.
J. G. Morris, Baltimore.
E. S. Morse, Salem.
A. S. Packard, Jr., Providence.
J. D. Putnam, Davenport.
C. V. Riley, Washington.
S. H. Scudder, Cambridge.
G. F. Waters, Boston.
O. S. Westcott, Racine.
S. Whitney, Watertown.

The meeting was called to order at 2.13 P. M. by the retiring President, Mr. J. A. Lintner, of Albany, who introduced the President of this meeting, Mr. S. H. Scudder, of Cambridge.

Mr. Scudder delivered his address as President [printed in September No.].

The report of the meeting at Saratoga was then read by the Secretary, and was approved.

The President read a letter from Mr. Wm. Saunders, regretting his inability to be present, owing to a severe accident. He also read the titles of papers which would be presented to the Club, in addition to those already announced in the circular.

Dr. Morris announced that he would present a paper by Prof. Cyrus Thomas on the "Migration of Locusts."

Mr. Grote was called upon first to read his paper on "Generic Characters in the Noctuidæ."

Prof. Cook followed with his paper on the "Contributions of Agriculture to Science."

Dr. J. G. Morris inquired whether Prof. Cook had ever tried to starve bees, and then furnish them with grapes, in order to learn whether they would puncture the grapes for the sake of obtaining the juices. Prof. Cook said that he had not done that, but that he had placed bruised grapes before them, which they sucked, and then he had placed whole grapes before them, but they would not puncture the skin. In response to a question, Prof. Cook stated that while he had never known bees to eat meat, yet they would suck the juices from meat.

The committee appointed to collect the informal ballots for officers reported that the following candidates had received a majority of ballots for the respective offices: for President, Rev. Dr. J. G. Morris, of Baltimore; for Vice-President, Prof. C. V. Riley, of Washington; for Secretary, Mr. B. P. Mann, of Cambridge. On motion, the informal ballot was made formal, and the candidates nominated were elected officers of the club for the ensuing year.

Mr. S. H. Scudder exhibited to the members several plates of his forthcoming paper on fossil insects, to be published in *Hayden's Survey*; also the manuscript figures of his contemplated work on Butterflies of New England.

Mr. Putnam, of Davenport, Ia., then read his paper on N. A. Galiodes.

Dr. Mark remarked that the poison glands of the *Solpugidae* had formerly been considered salivary glands.

Dr. LeConte said that in Honduras he had seen a species of *Galiodes*, or a closely allied form, running about on a table in which were many burrows of insects, and running into these burrows, from which occasionally it would draw a larva. He regarded these insects as probably poisonous, for, at one time, finding that some insect was crawling in his sleeve, he seized it to crush it, and received a series of bites at intervals of an inch and a half along his arm. As he had not met with any other insect at the place likely to attack him in such a manner, he believed it was one of these.

Rev. H. C. McCook followed with a lively and highly entertaining account of his observations upon the Honey Ants of the Garden of the Gods, in Colorado. The Honey Ant was first described from Mexico, in 1832, by Dr. Laws (?), who called it *Formica melligera*, but this description was overlooked by subsequent authors, and Wesmael re-described it, giving to it the name *Myrmecocystus mexicanus*. Little was known of it, however, beyond the honey-bearing workers. Sketching, in the first place, upon the blackboard, a diagram of the topographical features of the locality in which his observations were made, he said that the nests were invariably found near the summits of the ridges of land forming the inner horse-shoe of the Garden of the Gods, and placed upon the South or South-east aspect of these summits. This position seems to ensure to them almost entire immunity from injury by the rains, while the nests of *Pogonomyrmex occidentalis*, which are made on the very summit of the ridges, are greatly damaged whenever a storm occurs. Moreover, when storms occur, the entrance to the nests of the honey ants is guarded by a circle of sentinels, who stand within it, with their heads pointing toward the opening, and who, upon the occurrence of any injury, immediately proceed to make repairs. The nest presents externally the appearance of a mound of coarse red gravel, having at its apex a hole about ¾ inch across, extending vertically downward from 4 to 6 inches. The nest has been described as having no mound, but, at least in this case, it was as here described, whatever differences may sometimes be occasioned by a difference in the character of the soil in which the nests are excavated. From the bottom of this vertical hole the excavation is continued obliquely, and then branches out into stories of cells. Mr. McCook had found galleries extending a short distance from the central shaft in one direction, and 8 feet in the opposite direction. The rooms containing the honey-bearing ants are 5 or 6 inches long, 3 or 4 inches broad, and 1 or 1½ inches high. The floor is very smooth, but the roof is left rough, just as it was made by the tearing away of the particles of the gravel in which the nest is excavated. The average number of honey-bearers in a nest is about 300. These cling to the rough projections of this roof by their feet, their enormously distended abdomens hanging down. They are able to move sideways along this roof, and thus, in case the roof is slanting, to climb up. Their movements are at times quite rapid. Mr. McCook sought in vain for a long time to ascertain from what source the ants obtained their honey, as, although plenty of flowers were found in the vicinity, no aphides could be discovered. During the day-time the ants were not busy. At sunset they began to come out of their nests, and were tracked to a copse of scrub-oak trees (*Qu. radiata*) some 50 to 70 feet distant. Here, upon the trees, occurred the galls of a cynips, from which a saccharine secretion exuded during the night, and this secretion was licked up by the ants. In observing these galls Mr. McCook found that fresh beads of this sweet exudation appeared upon them three times during the night. (At this point some discussion occurred upon the cause of this exudation, but the subject was more fully discussed at a subsequent

meeting.) The ants, laden with this saccharine matter, returned to the nest, at the entrance to which they were challenged by the sentinels and induced to give toll. They threw themselves back in a rampant attitude and disgorged from their crops a bead of the fluid, which was imbibed by the sentinels with much eagerness. By daylight all the work was discontinued and the ants had retired within the nest.

Mr. McCook believes that the honey-bearing individuals are only some of the workers major, in which the crops have attained an enormous degree of distention. An examination of ordinary workers major which are fed with an excess of honey, shows that the crop gradually enlarges and crowds the following divisions of the intestine into the lower and posterior region of the abdomen. The structure of the alimentary canal is normal. Possibly, some of the workers major may be endowed with a special tendency to this development. The supposition that the distention was occasioned by a mutilation of the intestines, so that the ants could not evacuate their contents, appears to be disproved by the circumstance that the honey is retained before it reaches the stomach.

The manner in which the honey is supplied to the colony by these individuals, when they yield up their store, is not certain. It has been thought that the other ants tore open the abdomens of the honey-bearers and thus extracted the liquid, but it may be that the honey is regurgitated, as is done by the workers when returning from the harvest.

Mr. McCook did not finish the delivery of his paper, owing to the lateness of the hour, but was requested to favor the Club with a continuation of the account at another meeting.

Dr. J. L. LeConte then read a short paper containing a list of 22 Coleoptera which he raised from a small bundle of hickory twigs, calling attention to the importance of the observation of insects injurious to our forest trees, and to the ease with which considerable additions to our knowledge might be made. [Paper printed in October No. A. E.]

Rev. J. G. Morris said, that after hearing the remarks of Dr. LeConte upon this subject at the meeting of the Club last year, he undertook to raise insects from hickory twigs, and, with the assistance of Mr. O. Lugger, of Baltimore, had obtained over 30 species; but, unfortunately he had not been able to bring to this meeting a list of the species. Prof. S. S. Haldeman said that the hickory tree seemed to be more infested, whether alive or dead, by insects than any other tree.

Dr. LeConte then read his following paper on "Lightning Bugs."

Mr. Austin said that the flashes of light are always accompanied by a movement of the rings of the abdomen, by which a greater light-giving surface is exposed, and while the beetle is at rest only a faint light appears along the edges of the segments.

Prof. Riley considered that there was a logical correlation between the large size of eyes in the males of species which had brilliant but sluggish females, that could be explained on the principle of natural selection. The males with large eyes would most easily detect a crawling larviform female, while that female would be most readily detected which shone most brilliantly. Prof. Riley further remarked that the flashes of light serve to dazzle the eyes of pursuers, so as actually to disguise the position of the insects when they are flying about, and might thus serve as a protection from enemies.

Dr. E. L. Mark referred to a paper published in 1872 by Max Schulze, as having an important bearing upon the subject of the phosphorescence of these insects.

The meeting was then adjourned to meet at 8 P. M. at the Hotel Vendôme.

(To be continued.)

It is confidently asserted that the cotton crop of the present year will be the largest ever gathered—fully 5,600,000 bales, worth $300,000,000. It is also confidently stated that this increase is largely due to the operation of the entomological experts employed by the government in devising means to check the ravages of the cotton army worm.—*Practical Farmer*, Oct. 9, '80.

THE SCREW WORM.

BY A. R. KILPATRICK, M. D., GRIMES CO., TEX.

In the same mail I herewith send you specimens of half-grown Screw Worms taken from the root of a hog's ear. The hog had heen bitten by a dog on the ear a few days before, and the worms had nearly destroyed the ear of the hog when its condition was discovered; carbolized oil was applied to the sore, which caused the worms to move to the surface so they could be taken out with forceps. While the worms are in the burrow they constantly eject, or discharge, bloody water, which runs from the sore, and this discharge is very often the first intimation, or sign, of their presence. While they are sucking and not disturbed, or sickened, or disabled by any poison or insecticide, it is very difficult to dislodge them, as they hold on to the flesh with great tenacity, and as there are usually great numbers of them tightly imbedded in a hole.

These worms have been more numerous, more troublesome and more destructive this year than usual. All the newspapers of Texas have reported their ravages in stock, and amongst people, in all parts of the State. In Arkansas, Mississippi, and Louisiana, they are more numerous and destructive in years of overflow, and it is generally understood here that they are more numerous in wet years; and this has been an unusually rainy summer and fall.

They infested the slaughter pens and meat-stalls of the markets and deposited their larvæ on the meat, and the larvæ would instantly pierce the meat and conceal themselves, eat, grow and flourish. People refused to buy market-meat during the time of their prevalence. I tried to get some butchers to bring me the Screw Worm flies, but they would not do it, as they thought, no doubt, such a thing would injure their credit as butchers and diminish the sale of their meat. I regret that I failed to get a fly for you.

I herewith send slips clipped from newspapers in some counties in different parts of the State showing the ravages of the Screw Worms on people, and, of course, there were dozens of other instances which escaped the pencil of the country editors.

They were decidedly more numerous and pestiferous from the middle of September to the present time (9th Oct.) than they were earlier in the season. Frost always stops or destroys them:

Recently a lady of Collin County was out picking cotton, when a peculiar fly bit her on the nose. It was ascertained a few days afterward that Screw Worms had formed and made their way under the eye to the brain. Physicians were summoned, who administered calomel. Two hundred worms were extracted, and the lady is recovering.

Concho County.—*Times:* Screw Worms are unusually bad this season. Dr. Laton recently extracted over two hundred from the nose and head of a Mexican boy. Thanks to the doctor's skill, the boy recovered.

A Horrible Death.—Dallas, September 24.—An unknown man, supposed to be a German named Weijgleb, was found off the railroad in a vacant shanty, near Groesbeck, nearly lifeless and horribly afflicted with screw worms in the hands, feet and root of the spine. He had been lying in the shanty thirteen days without food or drink. Notwithstanding all efforts to save his life, he died soon after his discovery. He had on his person a pocket knife, one dollar in money, a watch chain and a locket containing two beautiful women, which he said were his sisters, and a certificate from a pawn shop in Dallas bearing the above name.

Mason County.—Some ten days ago, Katie, the ten-year old daughter of Thos. Mahoney, residing on Peters's prairie, was taken seriously ill, and, after a few days, was brought to town and placed under the medical charge of Dr. Grandstaff, who, on examination, discovered that she had been attacked in the nose and mouth by screw worms, caused, it is supposed by bleeding at the nose. There were a great many of the worms, and the sufferings of the little victim were almost intolerable. Dr. G. succeeded in removing over 250 worms from the nose and throat, and although still suffering somewhat from fever, it is believed that Katie will soon recover.

New Species of Scale Insects.—We publish in the present number a communication from Mr. W. H. Ashmead relative to a circular scale injurious to orange trees. We welcome with pleasure the work of all new entomological observers, but take this occasion to earnestly advise such to be cautious in the matter of descriptions of new species. Descriptive work can only be satisfactorily performed with the aid of extensive special literature, often difficult of access and expensive, while biological work, in its broadest sense, can always be carried on with the

aid of the one great book of Nature, open to all. In respect of scale insects it is often pardonable, because necessary, to name a species from the female scale alone without characterizing the male or the newly-hatched larva, but this should only be done where the female scale is quite characteristic.

We do not hold ourselves responsible for our manuscript name adopted by Mr. Ashmead which, while convenient to use in a cabinet, will probably have to be rejected upon more careful study or more complete knowledge of the sexual characters.

We announce with extreme regret the death, on the 29th of September, of Jacob Boll, of Dallas, Texas. He died while engaged on an exploring expedition for Prof. Cope, in Wilbarge Co., Texas. He was not only one of the best collectors and observers of insects, but proved himself one of the most intelligent and successful collectors in other departments of Natural Sciences. He also published a number of articles on botanical and geological, as well as entomological subjects. We knew him chiefly as an entomologist, and we have rarely, if ever, met with a man who combined more effectually keen powers of observation with skill in mounting and preserving the most delicate organisms. His aged grandmother and his children have our sincere sympathy in their bereavement.

Remedy for Cabbage-worms.—Of all the many topical remedies that have been tried for the Imported Cabbage-worm since it first began to spread over the country and to play havoc with our cabbage fields, few, if any, have given entire satisfaction. It is safe to say that the most satisfactory remedy so far discovered is in the use of Pyrethrum. We were the first to apply this in 1879, but did not care to recommend it until further experiments had been made. These we have made the present year, and caused to be made by a number of our agents and correspondents. The general experience is most favorable, and we unhesitatingly recommend it for all the different worms affecting the leaves of our cabbage plant.

Pyrethrum for the Screw Worm.—We publish in the current number an article from Dr. Kilpatrick on the Screw-worm which well illustrates the terrible wounds which this insect is capable of inflicting, not only on animals in Texas, but on human beings. One of the most important discoveries incidental to the work of the U. S. Entomological Commision which we have made during the year is that Pyrethrum may be successfully employed against this pest also. Prof. J. P. Stelle, one of the agents of the Commission, thus writes from San Marcos, Texas:

> I have just made a discovery that cannot be otherwise than of vast importance to Texas: Pyrethrum is a never-failing remedy for the notorious Screw-worm. The application is made by simply dusting a little of the dry powder over the sore; the worm being an air-breather, soon takes in the effect and dies.
>
> Up to this time the remedies for Screw-worm in Texas have been either arsenic or calomel. The former always leaves a serious sore, while the latter often does the same thing, and when applied to young calves always produces salivation. Pyrethrum leaves no unpleasant effects.

Oviposition in the Tortricidæ.—Prof. C. H. Fernald in his notes on *Phoxopteris angulifasciana* makes some interesting facts as to the oviposition of this moth which is one of those species in which the eggs are deposited singly. He describes the process as follows:

> "She fluttered about on the upper side of the leaf for a little time, then standing over and in a line with the midrib, she deposited an egg on the midrib, about one-third the distance from the end. In some cases only one egg was deposited on a leaf, in others, two; but in the latter case the second egg was deposited in the same manner as the first, but at a third of the distance from the opposite end of the leaf."

We wish some one could succeed in observing the more common form of oviposition in these moths, *viz.*, where the flattened eggs are so regularly and beautifully laid in large, translucent batches or long rows, upon the leaves or branches of plants.

Exchanges Wanted.—A. W. Latimer, Eufaula, Ala., is desirous of exchanging with collectors in Europe and of the Pacific coast.

EXTRACTS FROM CORRESPONDENCE.

Disease of Chauliognathus Larvæ.—During the last days of September I observed at Selma, Ala., on a fence enclosing a cotton field, many hundreds of the larvæ of the Pensylvanian Soldier Beetle (*Chauliognathus pensylvanicus* DeG.), see Fig. 122, both full-grown and young, most of them stiff and dead, others in a dying condition, and still others ascending the fence. Those still living had on all the stigmata a small drop of a whitish, odorless fluid, tasting somewhat like a rotten pear. In those larvæ which had recently died, these drops were pink in color, while in those already dead for some time they were dried up. This disease, very probably of a fungoid nature, destroyed many thousands of these larvæ; but I could not observe any further development of the fungus, though I visited the locality several times afterwards. The affected larvæ simply dried up, firmly adhering to the boards of the fence.

I will add that the larvæ of this beetle could be frequently observed in the earlier part of October, destroying the chrysalides of Aletia. —E. A. Schwarz, Selma, Ala., October 12th.

Herbivorous Ground-beetles.—In the October number of the ENTOMOLOGIST, Mr. Wm. Trelease records the finding of *Harpalus caliginosus* Say, feeding upon the seeds of *Ambrosia artemisiæfolia*, and asks whether it is common for predaceous beetles to seek at times a vegetable diet.

I cannot answer the general questions, but desire to confirm his observations by stating that in September, 1876, I witnessed the same phenomenon which he has described. In a field of several acres, nearly every plant of Ambrosia had one or more beetles upon it, and they were all *Harpalus caliginosus.* I could detect no other insects, and though I did not make a note of it at the time, my recollection is that some of the beetles appeared to be feeding upon the pollen of the staminate flowers as well as upon seeds. —Wm. A. Buckhout, State College, Centre Co., Pa.

About Phora being merely a Scavenger and not a true Parasite.—The opinion expressed by Mr. Hubbard in your September number (p. 228) about *Phora* not being a true parasite, holds good, no doubt, in the majority of cases. Among the literature which I have collected on the habits of *Phora*, I find only one direct statement about larvæ of this fly having developed in a *living* insect. Mr. Brischke (Kleinere Beobachturgen über Insecten), received from a coleopterist some pupæ and imagos of *Phora*, with the remark that the pupæ had come out of the anus of a living *Osmoderma*. The friend very probably meant to say that *larvæ* had come out and had immediately transformed into pupæ. The statements of Bouché (Naturg. d. Ins., p. 101) are less direct. He obtained larvæ of *Phora* from several specimens of *Sphinx convolvuli* in captivity, and from caterpillars of a *Tinea.* Although he does not say that the Sphinxes and caterpillars were alive, when the larvæ emerged from them, we are justified to assume from his wording that the larvæ of *Phora* had lived in their host, while he was alive, although they may have escaped after death. Brischke, (*l. c.*) also takes it that way.

Perris, in his *Insectes du pin maritime*, had expressed the same opinion as Mr. Hubbard, that the larvæ of *Phora* are scavengers, not parasites; but later (*Résultats de quelques promenades entomologiques;* in Ann. Soc. Ent. Fr., 1873, p. 74) he confesses his doubts about the matter. He had obtained a *Phora* from the nymphæ of *Coccinella 7-punctata*, these nymphæ not showing any signs of decay. Curtis (Brit. Ent. 437) and Rondani, (Atti, etc., Milano, 1860) relate similar observations. In such cases, the larvæ of *Phora* may have been *carnivorous*, without being *parasites;* they may have killed the nymphæ and eaten their contents. Zetterstedt's statement, "*larva (Phoræ) in Geotrupe nasicorni inventa, teste Marklin*" may, or may not, refer to a case parallel to that of *Osmoderma.* The case related by Goureau (Ann. Soc. Ent. Fr. 1855, p. 21) of pupæ of *Phora*, found in a box, in which, for about a month, he had kept a pinned *Psithyrus*, is likewise not conclusive, because the *Phoræ* may have slipped in the box and laid eggs on the putrescent specimen. Still, there is enough to show, in what precedes, that there is something to be learned yet about the habits of *Phora.*—C. R. Osten Sacken; Heidelberg, Germany, Oct., 1880.

[We thank Baron Osten Sacken for these bibliographical references. Whatever may be the case with other species of this genus it is perfectly clear that *Phora aletiæ* cannot be considered a parasite. We were of this opinion already in 1878, and for this reason did not allude to it among the enemies of Aletia. Our experience the past summer has fully confirmed this opinion. Mr. Hubbard has made a number of interesting observations which prove in the first place that the eggs are laid in masses not necessarily upon the insect, and never upon living or healthy insects. The larvæ very soon attack any decaying animal or vegetable substance, but while they may be thickly crawling about and over living larvæ they do not penetrate the same. We suspect that this will be found to be the general habit of the genus, and that where the *Phora* larvæ subsist on living insects (like Aphides) they are to be considered as carnivorous rather than parasitic.—Ed.]

Heliothis armigera feeding on hard Corn.—The Boll Worm or Corn Worm is exceedingly common and mischievous here this year. In some places every third ear of corn contains a worm. In one or two points the published descriptions seem deficient. The second brood, now growing, feeds, no doubt, on the milky kernels by choice, but not by any means constantly, nor does it confine its mischief to a single ear. Leaving the one on which it has been engaged, it passes to a second, which involves a journey down one stalk and up another. This is probably performed in the night. Its mandibles are capable of gnawing not merely the juicy milky kernels of the young ear, but the harder, riper ones of the ear when nearly mature and ready to cut. In cutting my own corn yesterday, I found many specimens of this insect, and there now lies before me an ear almost uninjured and nearly dry, the kernels being too hard to yield to the nail, and full of meal when broken, in which is an almost full-grown corn worm engaged in eating these hard grains. The worm has attacked the ear in two or three places and eaten about half a dozen corns, so that it is very plain that it has not spent its whole existence in this ear. The infested ears may often be detected on passing through the field by seeing a hole in the husk, through which the worm has entered the ear, and a few days ago I saw a half-grown worm gnawing its way into an ear, and making just such a hole. When I caught it, it had bored through the outer sheath only, and was at work on the second.—E. W. Claypole, Antioch College, O.

P. S. Later. I have as late as the first week of this month found small corn worms not more than half an inch long engaged in eating the ripe ears of corn, and I can add from experience that these small worms can bite sharply.

ANSWERS TO CORRESPONDENTS.

Gall on Solidago Leaves.—I mail you to-day a box containing specimens of *Solidago* leaves—am not certain as to the species, but think it is *S. nemoralis* (Ait.). I send them because they bear some new galls, or new ones to me, in which you may perhaps be interested. Should be glad to know the name of the gall. —Harley Barnes, Mulberry Corners, Ohio.

The galls on *Solidago* leaves are made by a little gall gnat which Osten Sacken described as *Cecidomyia carbonifera.*

Oak Gall: Cynips q-decidua Bass.—I send in to-day's mail a box containing some leaves of *Quercus mühlenbergii* Engelm, which have on them what I take to be the eggs of an insect. Thinking they may be of interest I send them. I would be glad to know what they are, at your leisure.—J. Schueck, Mt. Carmel, Ill.

The objects you send are not eggs, but a collection of galls made by a gall fly. The gall differs slightly from *Cynips q-decidua* Bassett, but is probably the same species. It is described in the Proceedings Entomol. Soc., Philadelphia, vol. III, p. 689.

Insects from Stomach of Lark, Robin and Sun Fish.—*S. A. Forbes, Normal, Ill.*—The *Diplotaxis* from the stomach of Meadow Lark is *D. sordida* (Say). The egg taken from the stomach of a Robin shot on the 10th of August is that of a Heteropterous insect, belonging to the *Reduviidæ.* As it is separated from its associates, and the gum surrounding it dissolved, it is pretty hard to determine. Nor can we state positively what the Ephemerid larva from Sun fish is, as we have reared but few. It may belong to the common *Polemitarcys alba* (Say), but this is only a guess.

Supposed hibernating Aletia Chrysalis.—Inclosed I send what to me is the chrysalis of the Cotton Worm I found in the piece of corn stalk as you see it, and it is alive now. Perhaps you may determine from this whether the worm is preserved through the winter in this way. If you think this throws any light on the subject, I will be glad to hear from you.—Respectfully, Jos. W. Davidson, Uniontown, Ala.

The chrysalis does not belong to the Cotton Worm, but is something entirely different, something resembling that of *Achatodes zeæ* (Harr.), the "Spindle-worm." We will endeavor to breed the moth in order to determine the species with certainty.

Sheep Parasites: Pyrethrum.—I notice in your paper read before the Scientific Association, at Boston, on the practical results of the Cotton Worm inquiry, that you have experimented with the powder of the Pyrethrum roseum. There is a disease in the south-west of the State known as Lambrize, that carries off hundreds of thousands of lambs every year. It is a red worm in the intestines. The powder could be easily administered with salt. Do you think it would kill worms internally?

The scab is increasing and will increase on account of the driving of scabby sheep to the new sheep walks in the north-west from Mexico and the south-west country. Sheep men are willing and keep working away with lots of nostrums. Tobacco, scientifically prepared and applied, is a cure, but it often fails. I am told that the active principle is nicotine, which is a product of the first fermentation, and is lost when it goes beyond that. This may account for the many failures with tobacco. I have no data to fix for the loss occasioned by scab, but judging from my own locality, by death loss, and deterioration of wool and clipping expenses, that it would reach a million and a half or two million dollars annually.—Alex. Mitchell, Waldrip, Tex.

We have had no experience with Pyrethrum as a cure for the sheep disease you first mention, but should be very glad to have you try it and report results through these columns. We do not know that it has ever been administered internally. That it will prove useful as a wash for the scab is more than probable.

THE

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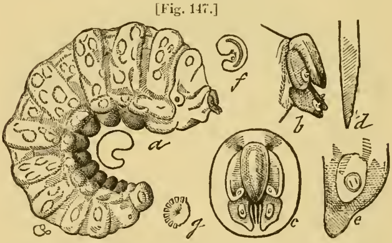
ON THE NATURAL HISTORY OF CERTAIN BEE-FLIES (Bombyliidæ).*

BY THE EDITOR.

We now come to the interesting and hitherto unrecorded life-history of two species of Bee-flies. On p. 305 of our First Report we figured an undetermined egg-parasite of the Rocky Mountain locust, giving some account of its extensive occurrence in and about the egg-pods of that insect, and showing that next to the Anthomyia Egg-parasite it was the most important enemy of the locust. The larva was somewhat anomalous. We were in doubt even as to what order of insects it belonged, placing it at the time in the Hymenoptera and, with a question, among the *Ichneumonidæ*. From the absence of spiracles on the intermediate abdominal joints we suspected, soon after the publication of our First Report, that this larva would prove to be Dipterous rather than Hymenopterous; while from such poor descriptions and figures as were extant, that most nearly approached it, we deemed it might be Anthracid, and were subsequently confirmed in this view by obtaining, in October, 1879, a single pupa from a lot of larvæ sent us by Mr. G. M. Dodge of Glencoe, Neb. Mr. Dodge sent us, with the same lot of larvæ, what he supposed to be the parent fly, reared from a lot of locust eggs among which the larvæ were found. His flies, however, proved to be the Anthomyia Egg-parasite (*A. angustifrons* Meigen, First Report, p. 285). The single pupa thus obtained from Mr. Dodge's specimen agrees with those of *Systœchus oreas*,* O. S., presently to be described.

During the past two years we have been in correspondence with Prof. J. G. Lemmon of Sierra Valley, Cal., who has kindly sent us many specimens of the locusts occurring there and especially the eggs

[Fig. 147.]



SYSTŒCHUS OREAS: *a*, larva; *b*, head, from side; *c*, do., from front, partly withdrawn into first joint; *d*, left mandible; *e*, left maxilla; *f*, prothoracic spiracle; *g*, anal spiracle (after Riley).

and early stages of *Camnula pellucida*.† Among such eggs these Bee-fly larvæ were, if anything, more common than we had found them among the eggs of *Caloptenus spretus* east of the mountains. We here quote one letter in illustration:

> By this mail I dispatch another cigar-box filled, this time, with sods containing eggs of the terrible locust that for three years past has devastated Sierra Valley; also the large, fat, white larva that lately made its appearance as a voracious feeder upon locust eggs.

* From advance sheets of the Second Report of the U. S. Entomological Commission.

* Western Diptera, p. 254; Bull. Hayden's Geol. and Geogr. Survey III., No. 2.

† This is the *Œdipoda atrox* of our First Report.

The ground that was first filled with locust eggs by the *Œdipoda atrox* by the end of September, looked as if scattered with loose shells, so thorough was the work of destruction.

A few of the grubs were detected in among the eggs in April, but not generally until August. One individual seems to empty several egg-cases before retiring from the feast and coiling himself up in a case which he has emptied, or in a nidus of his own make.—J. G. Lemmon in letter to C. V. Riley, Oct. 12, 1879.

During 1878 and 1879 we failed to rear any of them to the perfect state, but on June 20, of the present year, 1880, we obtained from these California larvæ the first fly. This proved to be a male of *Triodites mus* O. S.,* as kindly identified for us by Mr. S. W. Williston of New Haven. The delay in the printing of this report enables us to complete the natural history of these insects. We have, during the summer, reared many additional specimens of this species and also of the *Systœchus oreas* already alluded to. Prof. Lemmon and his brother, Mr. W. C. Lemmon, have also succeeded in obtaining the mature flies and have observed this *Systœchus* abundantly buzzing about over the ground in which the locust eggs were laid, as the following extracts from the correspondence of these gentlemen will show:

An enemy which has proved very destructive in Sierra Valley and vicinity is the larva of, as yet, an unknown insect. It is first observed as a large, yellowish-white grub, about half an inch or even three-fourths of an inch long when extended, it being usually curved so that the head and tail nearly touch. It is one-sixth to one-fifth of an inch thick just back of the head, and tapers slightly toward the tail; also flattened slightly dorsally. It is usually found in a case of locust eggs which it has devoured, pushing the empty shells aside, and at last occupying the space where were 21 to 36 eggs. Often it is found in a little space below a number of emptied cases as though it had feasted off the contents of several nests.

The grub was first noticed last April 20th in the egg deposits near Loyalton. This Fall, Sept. 7th, it was detected in great quantity near Sierraville, and afterwards in several infested spots of the valley. A handful of such soil will generally display ten to twenty cases of locust eggs, more or less emptied, and half as many of the fine fat grubs.—J. G. Lemmon, in the Sacramento, Cal., *Weekly Record Union*, Nov. 29, '79.

The white grubs ate out and destroyed thousands of the eggs last Fall, but to all appearance, have eaten nothing since, having lain dormant all winter, and being now found still among the eggs which are fast hatching out.—W. C. Lemmon, Sierra Valley, Cal., June 13th, 1880.

* Western Diptera, p. 246.

I send to you by this mail another package of the locust-egg-eating grubs, some of which you will find more developed. My brother, Prof. J. G. Lemmon, came up from Oakland day before yesterday to spend a few days, and while looking at the grubs that I had gathered for you yesterday, one of them developed into the Humble-bee fly which you have bred and a half dozen specimens of which I have caught and envelop rolled up in paper.—W. C. Lemmon, in letter to C. V. Riley, from Sierra Valley, Cal., July 18, 1880.

Happening home on a hurried visit I find locusts and destruction all around,—a sad, sad sight! Find my brother has tried to keep you posted up with specimens and notes. Am pleased to see a solution of the "big white grub" question. He develops into a species of fly, hosts of which are now seen in mid-day buzzing about among the locusts.—Prof. J. G. Lemmon, in letter to C. V. Riley, from Sierra Valley, Cal., July 18, 1880.

This habit in the larvæ of Bombyliids of preying on locust-eggs has not before been suspected, and in this connection we will review what has hitherto been known of their habits:

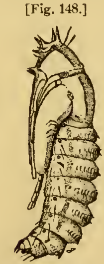
Prof. J. O. Westwood has given in the Transactions of the Entomological Society of London (1876, pp. 497, 498), the following observations upon the larval habits of Bombilii:

Thanks to the researches of previous observers, the economy and transformations of the *Bombylii* are now satisfactorily known to entomologists. Latreille rightly considered that the *Bombylii*, like *Anthrax*, were parasites, contrary to the opinion of Zetterstedt that the larvæ feed on the roots of plants (Ins. Lapp., p. 510). The pupa of *Bombilius major* was first figured by M. Imhoff in the *Isis* for 1834, having been found by him in a situation which he had previously noticed to be frequented by *Andrena humilis* (vol. 1834, p. 536, pl. xii.). In my Introduction (vol. 2, p. 538, 1840), I published a figure of the same pupa from a specimen discovered by Mr. C. Pickering in a sandy gravel pit at Coombe Wood on the 28th of March, from which the imago was produced in a few days. The pupa is very similar to those of the species of *Anthrax*, which are known to be parasites, having the fronts and underside of the head armed with strong spines, and the dorsal segments of the abdomen furnished with transverse rows of strong reflexed hooklets. In 1852, M. H. Lucas published the description of a new Algerine species of the genus, *Bomb. boghariensis* in the Annales of the French Entomological Society, 2nd ser. vol. x., p. 11, pl. 1, No. 11, which he had reared from a pupa found under a stone in a damp, sandy situation, and, contrary to the opinion of Latreille, he expressed himself thus: "je suis porté à croire que les larves qui composent ce genre ne sont pas parasites, comme le supposent Latreille et beaucoup d'autres Entomologistes, mais qu-elles vivent au contraire isolément dans la terre, —opinion, au reste, qui avait déjà été émise, mais avec doute, par M. Macquart, et que mon observation vient confirmer."

In 1858 the real history of the Bombylius was discovered by the veteran Léon Dufour, who, in the spring, found various exuviæ of the pupa of *B. major* sticking out of the ground, together with the newly-hatched insect, in places much frequented by various *Andrenidæ*, especially *Colletes hirta*, and who succeeded in the autumn, by digging on the spot, to find the larva "au milieu des déblais, où gisaient par-ci par-là des coques de Colletes" (Ann. Soc. Ent. France, 3rd ser., tom. vi., p. 505, pl. 13, fig. 111, and details). The larva is elongated, apod and fleshy, and of a white color. The preceding observations clearly prove that the larvæ of the Bombylii are parasites in the nests of other insects, in the manner of the cuckoo among birds. * * *

This last statement of Prof. Westwood is, however, not justified by Dufour's observations. On the contrary, Dufour expressly states that he did not observe upon what the larva fed; the inference which he draws is based upon the analogy of *Anthrax*,*and he inferred that it was upon the larvæ of *Colletes* that the grub fed—quite a different thing from being a cuckoo in the nest and feeding only upon the pollen. There is in Dufour's paper no evidence to prove that the *Bombylius* larva was found in the cocoons, or even in the cells, of the bee; he states, in fact, that he failed to find it there, but found it amid the clearings (*déblais*) which he had made in digging out the nest. Prof. Westwood himself found numbers of *Bombylius medius* flying in association with a species of Andrena in the unpaved Forum Triangulare of Pompeii, and also at the same spot the pupal exuvium of the fly protruding from the ground, which is presumptive evidence of the correctness of his conclusion.

[Fig. 148.]



Systœchus oreas: pupa (after Riley).

Dr. Packard ("Guide," etc., p. 397) states that "a species [of *Bombylius*] is known in England to lay its eggs at the opening of the holes of *Andrena*, whose larvæ and pupæ are devoured by the larvæ of the fly." But no authority is given for the statement.

*It has been clearly ascertained, and is well known, that *Anthrax* feeds in the larva state upon the young of certain bees. The larva of the *Anthrax* before attaining its full growth and before destroying its host must await the full growth of the latter, as it has by several observers been bred from the cocoons of the insect upon which it was parasitic.

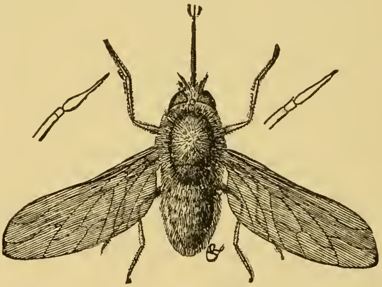
Messrs. Allen and Underhill in *Science Gossip*, 1875, p. 80, express their belief that the *Bombylii* are parasitic on humble-bees. In the volume for 1876, p. 171, they say (speaking of *Sitaris*):

In relation to the larva of this beetle, we would remark that this year we have found it clinging to *Bombylii*. This is "circumstantial evidence" that *Bombylii* frequent the nests of Anthophora to lay their eggs, since *Sitaris* itself, from its manner of life, cannot be the parasite of a fly, but only of a bee.

Locust eggs might well have been in the spots where Lucas, Dufour and Westwood found *Bombylius*.

From all these notes, it is clear that the true habit of Bombyliid larvæ had not been clearly ascertained. That they preyed parasitically on nest-building Hymenoptera

[Fig. 149.]



Systœchus oreas: female; antenna, side view, to left; do. top view, to right.

was rendered probable by what was known of the parasitism of the allied Anthracids; but we had only assumption without proof, and the experience we now record weakens the force of the assumption.

In his "Western Diptera" (*l. c.*, p. 243,) Baron Osten Sacken gives references to the published account of the parasitism of the Anthracid genus *Argyramœba* within the nests of *Cemonus* and *Chalicodoma*; cites Schiner's statement that the larvæ live parasitically in pupæ of Lepidoptera, and records the breeding of *A. cephus* and *A. fur* from the nest of a Texan mud-wasp which he referred, with a question, to *Pelopœus*, but which, as we have ascertained from an examination of the mud tubes which are deposited in the Cambridge Museum of Comparative Zoology, belong

to *Trypoxylon.* We have similar cells from Texas and other parts of the South. They differ from those of *Pelopæus* in being wider, ribbed on the upper surface and fastened not only side by side but in long tubes end to end. The *Pelopæus* spins a thin, yielding, semi-transparent, elongate cocoon of a golden-brown color with more or less loose silk around it, and the tail end darkened and docked; the *Trypoxylon* spins a tougher, thicker, more solid and smooth cocoon of a dull, bark-brown color, generally about half as long as the other (but varying greatly in size) and with the head-end often expanding into a flange.

We have reared what is very near, and probably identical with, *Argyramœba fur* from larvæ that had preyed on *Trypoxylon albitarse* which had made use of the mud cells of *Pelopæus lunatus*, or the Common Mud-dab, in Texas; also from the same wasp that had made use of the burrows of a bee (*Anthophora abrupta* Say).

The larva of *Argyramœba* has very much the same appearance as that of *Systœchus* and *Triodites*, and the pupa is distinguished from the pupa of this last principally by its longer and more numerous hairs, longer anal spines and more conspicuous spiracles.

The discovery of the "parasitism" of these Bee-flies upon locust-eggs at once suggests a comparison with the similar diversity of parasitic habits among the *Meloidæ* as given in our First Report, some of them infesting bee-cells, while others, as the true Blister-beetles (*Lyttini*) feed on locust eggs.

The Anthracids are now united by the best authorities with the *Bombyliidæ*, of which family as a whole, Osten Sacken has said;† they are "perhaps the most characteristic and one of the most abundantly represented families of *Diptera* in the western region, including California." The abundance of Blister-beetles is also well known to characterize this region, and we have shown how this abundance is connected with the abuadance of Locusts. It is of interest, therefore, to find that the Bee-flies bear a similar relationship of parasitism to the latter and that the characterization of the fauna in these two groups is really dependent upon the presence of the Locusts as well as upon the rich representation of the burrowing Hymenoptera.

With these general remarks we will now give a more full and descriptive account of the two Bee-flies which, by rearing from the larva, we know to have this locust-egg-feeding habit.

SYSTŒCHUS OREAS.

The character of the eggs and the manner in which they are laid have not yet been observed. The larva (Fig. 147,*a*) has already been described in our First Report (p. 305) and is found in the locust egg-pods or near them, of different sizes, during most of the year. These larvæ begin to transform to the pupa state early in the summer, and the pupa (Fig. 148) pushes itself half-way out of the ground in order to disclose the fly. These flies continue to issue during the summer months. As a rule but one year is required for full development, but there is in this respect great irregularity, and the same tendency to retardation which we have called attention to in the case of the Blister-beetles. We have had quite a number of the larvæ remain over unchanged till the second year, and all that we have said as to the philosophy of this retardation in the one case applies in the other. We are inclined to think that future observations will show, that there is a still further parallel in that the newly-hatched larvæ of the Bee-flies are much more active than in the later stages, and somewhat different in structure.

The three later states of the insect may be characterized as follows:

[We omit the more detailed descriptive parts of the article. With additional material we have been enabled to examine more fully the structure of the head than we had in giving the original description.* Underneath the median elevated piece,

† *L. c.*, p. 225.

*Ninth Mo. Ent. Rpt., p. 96.

which may represent the labrum, we find two stout spines faintly notched on the outer edge, which are doubtless the mandibles, and correspond to the two dark lance-like mandibles of other Dipterous larvæ, for they are retractible and run back into the thoracic joints, and remain after the other trophi are detached. The pair of feelers upon the upper lateral pieces, which seem to have no motion, might then represent the antennæ, and the two lower pieces, the maxillæ with their palpi ; while the labium is shown in a chitinous point visible only when the larva extends and raises the outer parts. A peculiarity in the movement of the maxillæ or lower pair of horny pieces is worthy of note. They move in alternation with one another in the forward and backward, *i. e.* up and down, motion. The palpus of these lower pieces when viewed from above is circular, with two dark marks indicating minute appendages. When the larva is fresh and plump it is almost white and shows most plainly the swelling of the thoracic joints and the translucences. Toward the period of pupation it becomes more opaque and more contracted.*

[Fig. 150.]

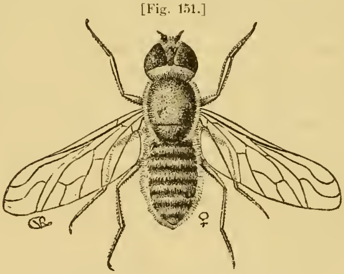
TRIODITES MUS: pupa (after Riley).

The pupa (Fig. 148) averages 8.5mm in length. The color is honey-yellow, but varies with age, the head and thorax assuming a dark color with maturity. The perfect fly (Fig. 149) is at once distinguished from the succeeding species by its broader form and long proboscis. The whole body is covered with long yellow or fulvous hairs. The species varies in the color of the legs and in size, some females being larger than the males. The species was originally described from Sierra Co., Cal., and Mr. Williston informs us that he has a specimen from Washington Territory.

TRIODITES MUS.

The habits of this insect in the larva state are precisely like those of the preceding, and the larva so greatly resembles that of the *Systœchus* that it is well nigh impossible to separate the two with certainty. The head parts are somewhat broader, shorter and less flattened, the maxillæ more blunt, the labrum paler, and the mandibles sharper and with a smoother outer edge. The thoracic joints bulge less beneath and the thoracic spiracle is more sunken and less conspicuous. The pupa (Fig. 150) is easily distinguished from that of *Systœchus* in the broader and more bulbous head, and in many structural characters. The larger head and eyes,

[Fig. 151.]



TRIODITES MUS: female (after Riley).

more slender form and short proboscis readily distinguish the fly from the *Systœchus.* The sexes are also readily separated by the more pronounced transverse rows of white or tawny hairs on the hind borders of the abdominal joints in the female (Fig. 151). The genus in some degree connects the *Anthracini* with the more typical *Bombyliini.* In certain lights the tegument reveals a greenish tinge, and the pubescence of the thorax appears generally of a tawny color. The male sometimes has a white tomentum on the front, and in some specimens there is a stump of a vein extending into the discal cell. As the *Triodites* is not yet known to occur east of Utah, we conclude that *Systœchus* is the genus most affecting the locusts in the Mississippi Valley.]

* So far as we can ascertain there has hitherto been published no recognizable figure or description of the Bombyliid larva. Dufour, in his article above alluded to, describes that of *Bombylius major* very indifferently, and gives a dorsal view which shows little or no relation to the larva here described, while his description and figure of the mouth parts fail to indicate the different pieces we have observed in our larvæ. Yet in general form and structure the true *Bombylius* larva will undoubtedly be found to agree very closely with those here described.

PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE ENTOMOLOGICAL CLUB OF THE A. A. A. S.

(Concluded from p. 274.)

At the meeting Tuesday evening, 24th August, in Parlor 15 of the Hotel Vendôme, Mr. H. F. Bassett, of Waterbury, Conn., made a communication upon the structure and development of some Hymenopterous galls, detailing the course of development of the galls of *Cynips operator* on *Qu. ilicifolia*. These galls, as well as those of *Cynips seminator* on *Qu. alba*, are developed from buds. Referring to a discussion contained some time since in the columns of "Nature," Mr. Bassett said that while some galls are undoubtedly abnormally developed buds, others are not buds at all. The young acorns of *Qu. ilicifolia* which are infested by *C. operator*, develop from their sides small pseudacorns in the fall. These pseudacorns fall to the ground about the first of September and remain 21 months before the perfect insects are developed from them. These perfect insects are all females. Their progeny inhabit woolly galls, which develop males and females in 90 days from the laying of the eggs.

Mr. Bassett regards the galls of *Cynips seminator* and *C. operator* as aborted leaf blades. The wool upon them is an excessive development of the pubescence of the leaf. In *C. operator* the egg is laid by the parent insect in the midrib of the leaf; in *C. seminator* it is deposited in the petiole.

These galls are made to grow by the deposition of poison in the puncture made by the parent insect when depositing her eggs.

The cynipidous galls are divided into two classes, viz: those which are produced in fall or winter or which remain undeveloped more than one season, and those which are produced and which develop in the spring. The galls of the former class produce only female imagos, while those of the second class produce males and females, the males appearing earlier.

Dr. Hagen said he had arranged three boxes at the Museum of Comparative Zoology, in Cambridge, to illustrate Adler's discovery of the dimorphism of Cynipidæ.

Mr. Riley said that a distinction should be drawn between galls produced entirely by the irritating action of the contained larva and those owing their origin entirely to the deposition of poison by the parent insect, and cited instances of galls produced in both ways.

The discussion recurred to the nature and source of the sweet exudation found upon the surface of galls on *Qu. radiata* visited by the honey ants (*Myrmecocystus mexicanus*). Mr. Riley cited observations and experiments which proved that the more common honey-dew is a natural extravasation of the plant, and should be distinguished from that produced by Plant-lice and Bark-lice. Dr. Hagen said he did not understand how a sweet excretion could be exuded from galls, which have an acrid nature. Mr. E. P. Austin remarked that the chemical composition of sugar and woody fibre are the same, and that sugar could be produced by conversion from woody fibre in the plant. Dr. J. L. LeConte said that he understood tannin to be a conjugation of gallic acid and sugar. Mr. B. P. Mann said that recent observations, which he had found described in a newspaper, had shown clearly the nature of much of the moisture which appears occasionally at night in great abundance on the leaves and other portions of plants, and which is usually mistaken for dew. This moisture differs from dew in being produced under circumstances which would not account for the formation of dew, and in containing a perceptible quantity of sugar. It is the ordinary watery excretion from the surface of the plant, which, under favorable conditions of the atmosphere, collects in beads or in drops, instead of evaporating as rapidly as it is formed.

Mr. Riley further said that many galls exude saccharine matter, amongst others those of certain *Phylloxeræ* on Hickory, one of which he had named *caryæ-gummosa* on

account of the abundance and stickiness of the exudation.

Mr. H. F. Bassett said that he found many species of galls visited by ants; he had also noticed them frequented by *Cetonia inda*.

Prof. Fernald followed with a paper on the Classification of the *Tortricidæ*.

Dr. Hagen read a paper on the supposed importation of the Hessian Fly, criticising the statements in Bulletin No. 4, of the U. S. Entomological Commission.

Mr. Riley said that he felt partly inclined to accept Dr. Hagen's conclusions; yet retardation of development is very frequent, and the Hessian fly hibernates in the flax-seed state for several months. It would be possible that young wheat had been pulled up, in the gathering of straw, and the insects conveyed in it, or that retarded puparia had been brought over in mature hay or straw.

Wednesday afternoon, 25th Aug. 1880, a meeting was called to take action upon the formation of a Permanent Subsection of Entomology, and such formation was effected.

A letter was read from Mr. W. H. Edwards, giving an account of numerous interesting results in the breeding of butterflies and some interesting captures. [This will appear in PSYCHE.)

Dr. McCook continued his very interesting account of the Honey Ants of the Garden of the Gods in Colorado. Two varieties are found, one of which is called *mexicanus* and the other *hortus-deorum*. Another variety is found in Australia. The alimentary canal of the honey-bearing worker is substantially the same as that of the other workers, and these individuals are only extremely gorged workers of the ordinary kind. The crop is surrounded with strong muscles, which serve to press out the honey when it is to be disgorged. The honey is slightly acrid to the taste, but very pleasant. Oscar Loew says that it is entirely neutral in winter. The Mexicans use it for an unguent, and also to form an alcoholic beverage. Mr. McCook found the queen chamber eight feet from the centre of the nest. This chamber was four inches in diameter. The queen was surrounded by courtiers, who by constant nagging caused her to go in any direction they pleased. The workers take care of the larvæ, and seem to enjoy taking them up and setting them down and moving them about, as a mother dandles an infant. They show no special benevolence toward each other, allowing disabled members of the colony to perish for want of care. While they would not wound the abdomen of a honey-bearer, but carried the bodies of the dead to a cemetery, they would feed upon the honey that flowed from a crushed individual. Their legs are provided with combs, with which they comb the hair on their heads and clean their antennæ and other limbs. They are apt to be infested with mites, which fix themselves immovably upon the head and antennæ and elsewhere. The nectar obtained by the workers becomes changed into honey in the stomachs of the honey-bearers. It is much thinner than bee honey, and at first is white; then it becomes of an amber or almost of a claret color. The number of ordinary workers in a colony is legion. Thirty honey-bearers were found in each of ten chambers, making three hundred in all. The honey-bearers were found in July and August, the only months when the nests were examined. It is not known at what other times they may be found.

Mr. Austin exhibited some plates which are to accompany a monograph of the Silphidæ by Dr. G. H. Horn, and called attention to a supplement to Crotch's Check List of Coleoptera, which he is about to publish; also to a proposed descriptive work on Coleoptera.

Mr. Riley read a portion of a paper by Prof. S. A. Forbes, on statistics of the food of the blue-bird, *Sialia sialis*. Prof. Cook doubted whether predaceous and so-called beneficial insects were generally of much practical benefit to agriculture. Prof. Cook considers the robin and the blackbird our great friends. Dr. G. F. Waters said that he had found in the

stomach of the king-bird, *Tyrannus carolinensis*, bees, a cherry-stone, a hairy caterpillar and a red locust.

On Friday afternoon, 27th August, at 4.15 p. m., Mr. E. Burgess gave a description, with illustrations on the black-board, of the structure of the mouth organs of Lepidoptera. Prof. Cook thought the proboscis might be unrolled by hydrostatic pressure, as the mouth organs of the bee are distended. Mr. Riley said that in *Trypeta solidaginis* the mouth parts are distended by the injection of a liquid when the fly is issuing from its gall. Dr. Hagen said that the proboscis of *Chionobas* contains very strong muscles.

Dr. Hagen read a paper on the anatomy of *Prodoxus decipiens.*

Prof. Fernald read a paper on *Phoxopteris angulifasciana.*

Mr. O. S. Wescott described a moth trap which he had constructed. He described also the manner in which a geometrical spider measures off the interval between the successive turns of the spiral in her web, by reaching out her leg at every knot, to graduate the distance of one thread from another.

Dr. Hoy described a trap constructed by him, for the capture of insects. Mr. Mann remarked that such a trap had been described as Mr. Glover's invention many years ago.

Mr. Grote said that he had found *Doryphora decemlineata* feeding on *Datura mitea.*

The meeting was then adjourned until next year

Silk Culture for Profit.—In the first issue of the *Daily Evening Transcript*, which bears date Boston, July 24, 1830, occurs the following advertisement :

FIVE THOUSAND SILK WORMS.

Silk Cocoons, Silk worms' eggs, etc., may be seen at No. 5 Tremont House. Also the process of the separation of the silk from the balls by reeling, and much curious and useful information obtained relative to the hatching and rearing of silk worms and production of raw silk.

Admittance, 12½ cents. Children half price. Season Tickets, 50 cents.

It is to be hoped that the Bostonian of fifty years ago availed himself of such an opportunity, and profited thereby.—C.R.D.

ON A NEW PYRALID INFESTING THE SEED PODS OF THE TRUMPET VINE.

CLYDONOPTERON TECOMÆ, NOV. GEN., N. SP.

BY THE EDITOR.

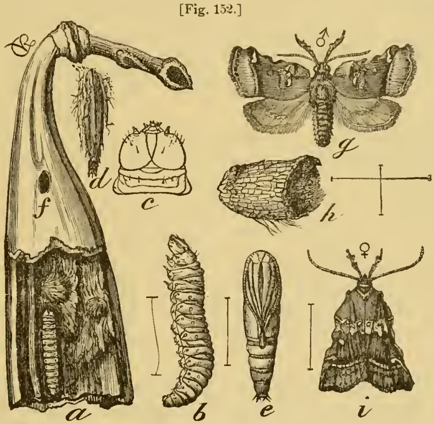
In opening the ripening pods of the Trumpet vine (*Tecoma radicans*) during autumn many of them in the Southwest will be found to require considerable force to separate the two halves, owing to the fact that they are bound together with a silken web. Upon separating the parts, close examination will generally reveal from one to a dozen dull, yellowish-white worms with more dusky brownish head and neck, and with the other normal characteristics of the larvæ belonging to the family, the smaller and larger larvæ closely resembling each other. These worms are generally enclosed in tough flattened cases among the peculiar, winged, flattened, brown seeds, which are then plentifully intermixed with dry, coarse, blackish, excrementitious grains. The silken case thus inhabited by the larva is opened at both ends, and generally has attached to it externally a mass of seeds from which the germ and cotylidons have been eaten out from one side. Before enclosing themselves for pupation it is the invariable habit of the larvæ to secure the two halves of the pod by a web as above described, to prevent the natural splitting and opening upon ripening. By the forepart of November the larva ceases to feed and remains dormant within its flattened cocoon (Fig. 152, *d*) attached to the inner wall of the pod until late in the following spring. About the middle of April the worm awakens and gnaws in the side of the pod a circular hole, which it fills up with silk and excrement. It then retires and transforms to a smooth, golden-brown pupa (Fig. 152, *e*). This pupa when about to give forth the moth does not partially emerge, as is so often the case with endophytous Lepidopterous larvæ, but the moth itself pushes, uninjured, through the lightly closed opening prepared while in its larval state. The moth issues at irregular intervals through most of the summer months. It seems to be strictly nocturnal and is not

attracted by light. It is quite rare and has never been found except about the Trumpet vine.

Neither the egg nor the mode of oviposition have been observed, though Miss Mary E. Murtfeldt, of Kirkwood, Mo., who was the first to observe the larva, and has carefully searched for the eggs, believes that they are inserted under the cuticle of the full-grown, green pod, as she has frequently found on such, small blistery elevations, each containing what appeared to be particles of the egg-shell, and concealing a minute puncture in the pod through which the newly hatched larva had evidently entered. The peculiarly flattened and spatulate nature of the ovipositor rather confirms this observation.

The moth is grayish in color,—front wings having purplish-brown markings with a few orange spots and a white dash at the outer third of the front or costal margin which is characteristically wavy. The female (Fig. 152, *i*) is somewhat larger than the male (Fig. 152, *g*), and he is at once distinguished from her by having a curious pocket on the costal border at the base of the front wings.

[Fig. 152.]



CLYDONOPTERON TECOMÆ: *a*, part of pod broken so as to show larva, nat. size; *b*, larva, side view; *c*, head and cervical shield of same; *d*, cocoon from side; *e*, pupa, ventral view; *f*, hole from which moth issued; *g*, male moth, expanded; *h*, pocket on his front wing; *i*, female moth at rest—hair-lines showing nat. size (after Riley).

The figures here used were made some two years since while we were connected with the Department of Agriculture, and we are indebted to Commissioner LeDuc for the electrotypes.

CLYDONOPTERON N. GEN.*

Comes near *Œctoperia* Zeller† but at once distinguished by having distinct, black ocelli, by the wings being somewhat narrower, the apex of primaries more rounded; by the median vein of secondaries not being naked; by the pocket at the base of the front wings of the ♂ having the opening less oblique and lacking the springs or bristles inside (described in that genus as keeping the pocket open), but more particularly by the sculpture of the costal margin of the primaries, which is here irregularly undulate with four indentions, deepest in the ♂, two basal ones about the middle of the wing in a rather broad and shallow excavation, the third being slight and the fourth, which is subterminal, still more shallow, and made between a subterminal bulging and the apex: the basal third of wing is strongly convex to shoulder. Antennæ alike in both sexes, subcylindrical, with about 44 joints; tapering to tip; labial palpi covered with long porrect scales above and below, produced at upper middle and lower tip of second and both above and beneath at middle of terminal joint and giving a laterally compressed appearance; the first joint very short, recurved, second joint nearly six times as long, terminal joint rather longer than basal; haustellum short with scales at base; maxillary palpi insignificant, in form of two broad bottons covered with hair.

Primaries with 13 marginals: Costal vein short, stout, joining subcostal near the base and reaching costa at the first indention; subcostal very stout at base giving off four branches which reach costa successively at the 3d elevation, 3d indention, 4th indention and apex, also with one branch beneath; disc complete; discal vein incurved, faint; median vein three-forked, the first fork from middle of the wing; submedian extending to lower apex; internal vein much bent and anastomosing, just beyond its middle, with the submedian by a faint oblique vein in the direction of the apex. The space between the rounded basal margin and the costal vein is excavated and ends at the shoulder with a stout membranous swelling narrowing toward base and obliquely docked distally, the space occupied on costa being ⅛ the length of the wing and twice as great as on costal vein; the docked end is

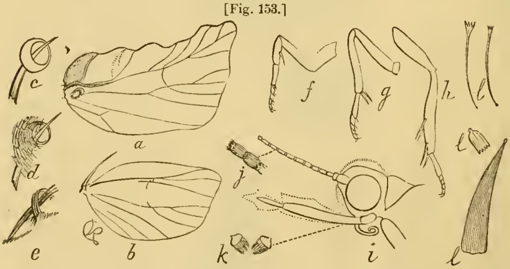
*Κλυδων, wave, πτερόν, wing.

†Berträge zur Kenntniss der Nordamericanischsen Nachtfalter, etc., in Verk. K. K. zool.-bot. Ges. in Wien, Jahrgang, 1875, p. 331.

closed by a white, ribbed, tympanic membrane, the ribs converging to a median depression. From the margin of this swelling issue long compact scales which form, with the somewhat curved costa and the excavation, a distinct pocket with a broad oblique mouth ; loop for insertion of frenulum in the ♂ strongly marked, horny, attached to subcostal vein and curving inferiorly so as to make an almost complete circle ;* in ♀ less complete, attached to median vein, consisting of 5 or more separate elements and curving anteriorly.

Secondaries regular in outline, with nine marginals, the costal divided at tip ; the subcostal incomplete at base ; the 3d anastomosing with costal at about the middle of the wing; disc incomplete ; indications of a discal vein which is incomplete at middle ; median divided terminally into three branches and sending off one more from base ; submedian faint, incomplete ; internal strong. Frenulum of ♂ very stout, simple; of ♀ tripartite. *Legs* of moderate length, normally spurred : front legs with coxa and femur subequal, tibia one-half as long as either : middle legs with coxa insignificant, tibia and femur subequal, the tibia having two bunches of scales, heaviest in the ♂, the terminal largest ; basal joint of tarsus also with such a bunch : hind legs with femur about three-fifths as long as tibia, the scales being rather heavy at tip of tibia and also on first joint of tarsus.

[Fig. 153.]



STRUCTURE OF CLYDONOPTERON TECOMÆ : *a*, front wing of male showing venation and membranous swelling at base ; *b*, hind wing do.: *c*, frenulum and loop ; *d*, do. covered with scales ; *e*, do. of female ; *f*, *g*, *h*, front, middle and hind legs ; *i*, head, the dotted lines showing outline of scales ; *j*, enlarged antennal joints ; *k*, maxillary palpi ; *l*,*l*,*l*, forms of scales (after Riley).

C. tecomæ n sp.—Average expanse ♀ 20^{mm} ; ♂ 15^{mm}. General color smoky-gray, the primaries suffused with purplish-brown and ferruginous. Antennæ pale in the ♀, with faint purplish annulations in ♂ ; palpi purplish above, gray beneath. Thorax concolorous with primaries, the collar and tegulæ having a few deep-gray or blackish scales. Abdomen purplish-brown ; the ♂ genitalia covered with scales, simple, the spathe broad at base and tapering to a point, the claspers tapering when viewed from above and equal in width when viewed from the side ; basal piece tapering proximally ; the ovipositor in ♀ extensile, to half the length of abdomen, two-jointed, the tip chitinous flattened and recalling in form the bill of a duck. Primaries purplish-brown, deepest toward the outer third of wing, which is marked by a transverse line of the same color intensified, this line being slightly incurved to the subcostal vein and thence elbowed to costa and marked by a conspicuous white dash something like an inverted interrogation point : this line is relieved by two outer coincident shades of a paler color, the posterior one being pale gray ; posterior border pale gray with a series of black spots between the veins ; fringes purplish-gray ; pocket of the ♂ pale inside toward the membranous base, purplish outside ; from about the middle of the basal bulging of the wing or just outside the pocket a very narrow whitish oblique line, broadening into a distinct white spot on the subcostal and median veins, this spot most often in the shape of a *c* but sometimes separated into two and at others into three distinct spots, the wing outside this line and spot and beneath it being suffused with deep ferruginous scales, and a circular spot of the same color about the middle of the wing between subcostal and median veins. The purplish and orange markings are deepest in the ♀, the orange in the ♂ being frequently pale ferruginous inclined to yellow. Secondaries smoky-gray with a darker discal spot and double transverse shade about the outer third, following the margin. Under surface of primaries pale yellowish-gray, with the white dash at posterior costal prominence and the intense purple of upper surface repeated near costa. Under surface of secondaries darker, more purplish, the discal spot and curved bands of upper surface being more intensified, almost black, with a double transverse band of the same color at base.

Described from numerous specimens bred as stated.

Larva—Of normal form ; rather broad and somewhat flattened. Average length when full grown 9^{mm}. Color, dull yellowish. Head almost horizontal, deep, polished brown. Prothoracic joint dingy ; cervical shield broad and concolorous with head, having a medium paler line and four transverse darker impressions. Anal shield less horny and paler. Each abdominal joint divided in two transverse folds, the posterior one-half as wide as the anterior. A substigmatal longitudinal fold rendered undulate and moniliform by deep sutural impressions. Stigmata large with conspicuous black annulus. Piliforous spots insignificant, and their hairs fine and pale. Prolegs short with light-brown hooks.

Pupa—Mahogany-brown, the hind tarsi extending just beyond wings in two lobes; the abdominal joints minutely punctulate dorsally, most densely on anterior borders; the tip of body darker, suddenly compressed from above and beneath so as to form a transverse edge with 6 projections and a blunt spinous hair extending from each.

* Our figures of these parts are somewhat imperfect.

EXPERIMENTS WITH YEAST FERMENT ON VARIOUS INSECTS.

[Among the various experiments which we have had made with Yeast Ferment as an insecticide, during the present year, the following from two well known observers will prove of interest.—Ed.]

EXPERIMENTS BY PROF. J. E. WILLET, OF MACON, GA.

The Cotton-worm (*Aletia argillacea*) made its appearance in this State late in the summer, and not in large numbers. The first reported to me appeared in Mitchell County, near the line of Georgia and Florida, August 31st. From the prevalence of the great gale of that date, no experiments were attempted with that brood. The following experiments were made with larvæ of the next brood.

In the experiments made by me, last year, it was observed that the cotton leaves which had been sprinkled with beer and yeast and were fed to the cotton-worms in confinement, adhered together, when the larvæ "webbed up" in them and remained moist and liable to mould. This was suspected to be one cause of the great mortality in the larvæ and pupæ. To guard against this the beer, in the following experiments, was made with much less sugar, and the yeast was more diluted. Both, however, were very active and were full of the fungus cells.

September 20th, one hundred and fifty larvæ, about half-grown, were selected and placed in three suitable boxes, fifty larvæ in each box. Those placed in the first box were supplied, from time to time, with fresh cotton leaves sprinkled with beer; those in the second box with cotton leaves sprinkled with flour yeast; and those in the third box with leaves sprinkled with water. The last served as a basis of comparison with those fed on the beer and yeast ferment.

September 29th, all the living had webbed up, the larvæ having fed on the sprinkled leaves from five to nine days. October 19th the last moths emerged. The long delay in the pupa state was doubtless owing to the prevalence of a cold northeaster. They were kept in confinement till October 27th, to permit the escape of any parasites from the pupæ. None have been seen. As the larvæ were taken from the field, when two or three days old, and were fed in confinement until those for experiment were selected, there was probably no opportunity for attack from insect enemies.

The leaves were not disturbed while the larvæ were webbing; fresh cotton limbs being simply laid on those, in which the worms were spinning. When all the worms had pupated, the old leaves containing most of the pupæ were found to be damp and mouldy, especially those which had been wetted with beer and yeast. The leaves therefore were separated, and the pupæ were carefully removed and placed on cotton batting in smaller paper boxes.

The mortality was as follows: of those fed on leaves sprinkled with water and with beer, none died in either the larva or pupa stage. One moth from the larvæ fed on beer was imperfect, and did not fully expand its wings. Of the larvæ fed on cotton sprinkled with yeast, two larvæ and three pupæ died, or about ten per cent.

Last year, the greatest mortality occurred among the larvæ fed on beer; this year there were no deaths in connection with the beer. The beer had an excess of sugar, which when applied to the leaves rendered them very sticky. This was remedied this year by the use of less sugar. The same result was attempted in the case of the yeast by dilution; but the success was incomplete, by reason of the imperfect solubility of the gluten, dextrine and other constituents of the fermenting flour. Even when much diluted with water, the yeast coated the leaves with a white film, which resisted most successfully the action of rain and dew.

From its greater fluidity and hence a more general action and reaction, we should expect the beer to contain a greater number of yeast germs, and to be more potent in its effects than yeast.

The result of the experiments is, that the fungus in the form of active beer from sugar produced no deaths, and that ten per cent. of the worms fed on cotton sprinkled with yeast died. This last was about one-fourth of the mortality in connection with yeast last year. As the dilution of the beer was followed by total absence of mortality, and the dilution of the yeast was accompanied by a reduction of the mortality to one-fourth, the adhesiveness of these menstrua, in clogging the bodies and spiracles of the larvæ, and in thus interfering with the function of moulting, may be a sufficient cause of the deaths of larvæ and pupæ observed in both years.

I desired to carry on similar experiments in the field, but the season and circumstances of a personal nature prevented. A single trial on a small scale, was made on worms colonized on some cotton plants in my garden. They fed from three to six days on plants sprinkled with both beer and yeast. Ten chrysalids were gathered from the plants and placed in boxes. They seemed very healthy and none died.

In conclusion, I think these experiments furnish no ground for hope of successful attack on the Cotton-worm with Yeast Ferment.

EXPERIMENTS BY PROF. A. J. COOK, OF LANSING, MICH.

September 8th, 1880.—I placed twenty squash-bugs in each of four boxes, two of which were closed, and the others covered with wire gauze. Ten of the insects in each box were yet immature, the other ten were imagines. I also placed fresh squash leaves in each box. The contents of two of the boxes, one of them closed and the other covered with gauze, were thoroughly sprinkled with yeast diluted with tepid water in the proportion of one part of yeast to four of the water. The insects in the other boxes were simply for comparison, and received none of the yeast liquid, though the leaves were sprinkled with water. I also treated some bugs which thickly covered the ground beneath a squash vine with some of the yeast liquid. In one week fresh leaves were added to all the boxes, when the contents of each box were sprinkled the same as before. The bugs beneath the vine also received a second application of the yeast.

Daily examinations showed no deaths in any of the boxes, though some of the pupæ in every box changed to imagines. I could see no evidence that any of the bugs which were unconfined under the squash vine, and treated with the yeast, were in any way injured.

The same set of experiments was tried with the potato-beetle (*Doryphora 10-lineata* Say), except that the leaves were renewed daily, and moistened, or rather drenched, each time with the yeast liquid or water. In the two weeks three of the larvæ in the boxes with no yeast died, and five in the other two boxes. At the end of the two weeks eight of the larvæ in the boxes which contained the yeast had entered the earth, and eleven of those in the other boxes had done the same. Upon digging these up, they all seemed in good condition. So far as I could judge, the imagines in the boxes, and the larvæ and beetles on the vines, which also received two applications of the yeast at an interval of a week, received no injury from the treatment.

The same experiments were tried with the caterpillars of the Cabbage-butterfly (*Pieris rapæ*). During the first twenty-four hours two of the larvæ changed to chrysalids in three of the boxes, and three in the other one of the closed boxes which had received the yeast. Before the expiration of the two weeks, all had changed to pupæ, and not one had died. Those larvæ which had been sprinkled on the cabbage plants received no apparent injury.

Sprigs of Alder (*Alnus serrulata*) thickly covered on the underside with a wooly plant-louse (*Eriosoma tessellata* Fitch), were dipped into the yeast liquid September 8th, and again September 15th, without any perceptible injury.

The weather during these experiments was quite warm and pleasant.

NOTES ON THE IMPORTED ELM LEAF-BEETLE.

BY THE EDITOR.

Anent *Galeruca xanthomelæna* which is becoming more destructive each successive year to the shade elms in our own northern towns, a correspondent mentions the following facts:

(1) "The trees are not all attacked at the same time, but the insect seems to break out from a centre, gradually destroying the more remote trees, so that isolated trees remain comparatively free."

(2) "After applying a band" (saturated with fish oil, petroleum, etc.) "to some trees which were about half denuded, I found hundreds of the worms stopped both in ascending and descending the trees."

He also propounds the following query:

(3) Do the beetles hybernate in the ground so that they can be poisoned, or are they perpetuated only by the eggs on the trees?

Allow me to add the following subjects for investigation as necessary to the devising of proper remedies against this foreign invader.

(4) How soon do the insects appear in the Spring, how rapidly do they propagate, and what time is passed in each stage of development?

(5) Are the larvæ and beetles eaten by insectivorous birds, or are they protected by offensive secretions as is the case with *Doryphora* 10-*lineata*, *Orgyia leucostigma*, and several other noxious insects?

(6) What proportion of the brood hybernates, and in what stage, pupa, or perfect insect? and where?

If the materials for furnishing answers to these questions are not yet within your reach, will you kindly direct the attention of some of your trusty observers to the subject, so that persons interested in the preservation of the shade trees which are so justly esteemed, may be properly instructed as to the measures to be adopted during the next summer. Very truly yours,

J. L. LeConte, Phila, Pa.

Though the above inquiries were received from our esteemed correspondent some time since, we employ them as a ready means of giving our experience with the beetle in question.

For the benefit of the general reader it may be remarked that the natural history of this Elm leaf-beetle is quite similar to that of the well-known Colorado potato-beetle and of the Grape-vine flea-beetle both of which have been treated of in the columns of this magazine. The only deviation in the Elm leaf-beetle is in the mode of pupation which rarely takes place in the ground, unless this be very friable, but at the base of the tree or under any shelter that may present itself near the trees, such as old leaves, grass, etc.

(1) The phenomenon here described is doubtless due to the gradual increase in spring from one or more females.

(3 and 6) Like most, if not all, *Chrysomelidæ*, the Elm leaf-beetle hibernates in the perfect state. As places suitable for hibernation abound, any attempt to successfully fight this pest in winter time, with a view of preventing its ravages the subsequent season, will prove fruitless. A large proportion of the hibernating beetles doubtless perish, since the insect is comparatively scarce in the earlier part of the season.

(4 and 5) The beetles fly as soon as spring opens, and we have observed the first larvæ early in May in Washington, D. C., or sometime after the Elm leaves are fully developed. The ravages of the insect begin to be apparent with the second generation of larvæ which appear in June.

In 1878 we made many notes and experiments on the species, and the development of the third and most injurious generation occupied about one month. The numerous pupæ which in the latter part of August were to be found under the trees were mostly destroyed that year, partly by continuous hot weather prevailing at the time, partly by the many enemies of the insect. Among these there are: *Platynus punctiformis* and *Quedius molochinus* which feed on the full-grown larvæ when these retire for pupation, and also on the pupæ. The larva of a *Chrysopa* (probably *C. rufilabris*) feeds upon the eggs of the *Galeruca; Reduvius novenarius* sucks both beetles and larvæ on the leaves, while *Mantis carolina* preys upon the beetle. Of the numerous other insects found among the pupæ under the trees, *e. g. Tachyporus jocosus*, sundry spiders, myriapods, *etc.*, several are doubtless enemies of the *Galeruca*, though we have as yet no proof of the fact. Many birds were observed on the trees infested by the beetles, but the English Sparrow, which was the most numerous, did not feed on the insect in any stage of growth.

The only method of warfare against this

pest recommended by European writers is to jar the larvæ down onto sheets and then in one way or another to destroy them. This may answer for young trees but is then tedious and but partial. We found that the quickest and most satisfactory way of destroying the insect and protecting the trees was by the use of Paris Green and water in the manner frequently recommended in these columns, and London Purple will evidently prove just as effectual and cheaper. The syringing cannot be done from the ground except on very young trees, though a good fountain pump will throw a spray nearly thirty feet high. Larger trees will have to be ascended by means of a ladder and the liquid sprinkled or atomized through one of the portable atomizers, like Peck's, which is fastened to the body and contains three gallons of the liquid.

The mode of pupation of the insect under the tree on the surface of the ground, beneath whatever shelter it can find, or in the crevices between the earth and the trunk, enables us to kill vast numbers of the pupæ and transforming larvæ by pouring hot water over them. We found that even Paris green water poured over them also killed. If the trees stand on the sidewalk of the streets the larvæ will go for putation in the cracks between the bricks or at the base of the tree where they can also be killed in the same way. This mode of destruction is, take it all in all, the next most satisfactory one we know of, though it must be frequently repeated.

(2) We have largely experimented with a view of intercepting and destroying the larvæ in their descent from the tree. Troughs, such as are used for Canker-worms, tarred paper, felt bands saturated with oil, are all good and the means of destroying large numbers. Care must be taken, however, that the oil does not come in contact with the trees, as it will soon kill them, and when felt bandages are used there should be a strip of tin or zinc beneath them. The trouble with all these intercepting devices, however, is that many larvæ let themselves drop down direct from the tree and thus escape destruction.

In conclusion we would remark that it is highly probable that Pyrethrum powder stirred up in water might be successfully substituted for arsenical poisons, but experiments in this direction have not yet been made. From experiments we have made with the dry, unmixed powder, we found that it affects very quickly the larva, pupa and the perfect insect, but in order to be applied on a large scale and on large trees the powder must of course be mixed in water. There is, however, no danger in the judicious use of the arsenical liquids upon shade trees.

THE BUG IN THE PEA.

The farmer has many pests to contend with, and the number is increasing annually. Foremost among them now is the Pea Bug, which has done great damage in past years; and with the great stock of bugs on hand, we may expect great ravages another year, unless something is done to stay them. It is our duty, then, ere it is too late, to consider what is best to do. If there is a remedy it is high time we knew of it, as spring will soon be here, and then there will not be time for finding out what is best to do. From what I know, and can learn from my fellow-farmers in this section, all those who had sown late in the season escaped the bugs almost entirely, and also that those who had sown the Prussian Blue Pea the last two years have been free from them. Now, if such is the case in other places, I think it would be well for all to know, as it is very easy for others to report from different sections of the country through the columns of your paper. Hoping this may cause the opinions of others to be expressed, I leave it for able pens.—J. L. Carville, in *Farmer's Advocate*, Canada.

Late sowing is probably one of the best methods of checking the increase of the pea-weevil, but the farmers must also be very careful to destroy every weevil found in their seed peas, and to do this, the peas should be kept in strong, closely-woven bags, or, what is better, tight barrels, and then the weevils will all leave the peas before the time of sowing a late crop, but not being able to escape into the open air, can be easily destroyed. We have our doubts in regard to what is called the "Prussian Blue" pea being weevil-proof, as this insect is not at all particular as to the variety it attacks; the hardest and poorest sorts being just as acceptable as the most delicate and finest flavored.—A. S. F.

SYNONYMS OF PARASITES: MISTAKES CORRECTED.

Mr. L. O. Howard, of the Entomological Division of the Department of Agriculture, who, we are glad to learn, is making a specialty of the *Chalcididæ*, gives reasons* for considering *Antigaster* Walsh synonymous with *Eupelmus* Dalm. He states that there were "no grounds for the founding of the genus *Antigaster*," a statement which we believe is hardly justified. Westwood characterizes *Eupelmus* as having 13-jointed antennæ with the club ovate. Walker, in 1869, recognized *Antigaster*, stating that it was allied to *Eupelmus* and *Notanisus*, and, in 1872, gave as the distinguishing character of *Eupelmus* "the middle tarsi with bristles," and the genus is figured with such bristles by Snellen von Vollenhoven. *Antigaster* is sufficiently distinguished in the ♀ by its 10-jointed antennæ† with the club obliquely truncate from beneath; by the basal joint of middle tarsi being non-bristled, but widely compressed and finely dentate beneath; by the abdomen strongly broadening behind, and by some of the ♂ characters.

The minuter parasites belonging to the *Chalcididæ*, *Proctotrupidæ* and *Cynipidæ*, in their broader sense, are most interesting subjects of study, and we confidently expect important and valuable results from special study of them in this country, such as Mr. Howard intends to give; and this reminds us that, from a study of Förster's paper on the Cynipidæ, which we have been able to make through the courtesy of Mr. Wm. H. Patton, we believe that our genus *Didictyum*, characterized on page 52 of this volume, is synonymous with Förster's *Hexaplasta* and must therefore sink. Authors have given us, so far, no characters which will enable us to properly place some of the osculant forms between the three families here mentioned, and it is questionable whether any characterizations can be formulated which will cover all requirements. This little parasite will therefore, in future, be known as *Hexaplasta zigzag* (Riley). It is, by the way, not a parasite of Aletia as we had been led to believe from the statement of Prof. Comstock who referred it to us, as such, but, as we have had good evidence the present year, a parasite of *Phora aletiæ*. The parasite is not gregarious, but singly infests the Phora, going through its transformations in the pupa of its victim and issuing from a hole eaten in the upper anterior part thereof.

* *Canadian Entomologist*, October, 1880, p. 209.

† The club cannot, in any justness, be separated into 3 joints, and it requires a stretch of the imagination to make out an additional one between joints 2 and 3, which is the only way to account for Westwood's diagnosis, supposing that the antenna in *Eupelmus* has the same number of joints as in *Antigaster*.

"A MYSTERY IN REFERENCE TO PRONUBA YUCCASELLA."

The above is the title of a communication by Dr. H. A. Hagen in the July number of our contemporary the *Canadian Entomologist*. Dr. Hagen had been breeding *Prodoxus decipiens*, described in our June number, and mistook it for *Pronuba yuccasella*. He mentions having *carefully* compared his moths with typical specimens and that his comparison left no doubt that those bred from the stem were *P. yuccasella*. In an addendum to the article, written after Dr. Hagen had seen our remarks on p. 142 of this magazine, he further declares that the basal joint of the maxillary palpus in his two females "is produced into a spinous tentacle just as in Pronuba." This statement was such a surprise to us that we wrote to the *Canadian Entomologist* giving our reasons for believing that Dr. Hagen must have been mistaken. In August when we met Dr. Hagen at Cambridge he at once confessed his mistake and admitted that we were right, though he gave no explanation of the way the error was made. In his interesting remarks on the anatomy of *Prodoxus* no reference was made to the former error, except so far as it was implied in the acceptance of our species. As no correction of the error has yet appeared in the columns of our contemporary and as the original statement of Dr. Hagen was so circumspect and emphatic we cannot let the matter drop, but are constrained to thus insist on the correctness of our own observations

MANDIBLE OF LITHOCOLLETIS GUTTIFINITELLA.

We give herewith the figure necessary to complete Mr. Chambers's article in the November number, "On the Changes that take place in the Mouth-parts and Legs of some Leaf-mining Lepidopterous Larvæ," and which was unavoidably omitted last month. The figure represents the mandible (with its socket and chitinous supports) of the first five stages of the larva, and is used for comparison with the mandible of *Phyllocnistis* (Fig. 137, p. 261.)

[Fig. 138.]

Mandible of *Lithocolletis guttifinitella.*

Excessive Injury by a Beetle in Russia.—We noticed recently the accounts given in Russian newspapers of the mischief which is being done by locusts. One of the most destructive insects in South Russia is the beetle called by naturalists *Anisoplia austriaca*, and by the rural population of Kherson, *Gonzka*. This insect first appeared in 1865 in the Melitopol district, but there is nothing known as to how and whence it came, as it had never been heard of in any other part of Russia or bordering countries. The form of the insect is oblong and slightly convex; it is of the size of a grain of ricinous seed and of a cinnamon color. The change from egg to larva, and from larva to a full-grown beetle, takes nearly two years. The female lays her eggs about two inches deep in the earth, and the grubs, after leaving the eggs, grow very slowly, live the whole winter in the earth, finding nourishment in the soil, and then become more developed, but remain as grubs the following summer and winter; then, on the approach of spring, they rise to the surface of the ground, where they accumulate. As many as ten bushels of the beetles have been collected from one acre of wheat. They fly from ear to ear, and do not quit it until it is destroyed. They are capable of making long flights from one Government to another. Last summer a mass of these beetles was discovered in the sea, near Ochakoff. They were so thick that it was difficult to pull a boat through them. They were gradually washed on shore, and the people, instead of taking prompt measures, allowed them to remain there. When at last they recognized the danger with which they were menaced, persons were sent with horses, casks, etc., to destroy them, but it was too late; about three-fourths had recovered strength and flown into the neighborhood to form a new generation in that district. The British Vice-Consul at Nicolaieff reports that unless efficient measures are adopted it is probable that all agricultural Russia will eventually become the prey of these insects, causing privations hitherto little known in the country. He considers that the subject demands the serious attention of Europe, as Russia supplies so many countries with wheat, and her misfortune may raise the price of American produce.

Mr. Charles A. Green remarks *the Colorado beetle's evident dislike of potato tops grown in the shade.* I have observed the same thing—a row only partially shaded by apple trees being wholly untouched, while others alongside of them are eaten badly. I have supposed that the absence of sunlight renders the foliage of less agreeable flavor, and that after the fully exposed rows are defoliated the enemy will attack the less palatable supply. I notice also that the beetle has preferences in respect to varieties. A row of White Elephant is left almost untouched, while a row of Early Ohio alongside of it is covered with the destroying insects.—*N. Y. Weekly Tribune.*

Chemical Change in the Color of Butterfly-wings.—Mr. W. H. Edwards, of Coalburgh, W. Va., communicates to *Psyche* for July an interesting experience as to the effect of carbolic acid on the color of *Limenitis*, from which it appears that rich purple is changed to metallic blue or even green by this acid. This would seem to prove the correctness of Mr. Dimmock's conclusions that the colors in the wings of insects are pigments.

THE PHYLLOXERA AT THE CAPE.—We are sorry to observe from the *Cape Times* that M. Cornu has recommended the Cape Government to continue their restrictive regulations with regard to the Phylloxera. No doubt, in the abstract, and if one side only of the case be looked at, M. Cornu is right; but there are many points to be considered, and the general outcome is that while, on the one hand, no restrictive enactments can in the long run be efficacious in excluding the insect, they will, on the other hand, inflict gratuitous injury on the welfare of the colony by restricting the importation of roots, bulbs, plants other than vines, or coming from countries where no vines grow. If natural barriers and climate do not keep out the Phylloxera from the Cape, no artificial restrictions that man can devise will do so. The evidence on the continent of Europe is decisive on this point.—*Gardeners' Chronicle.*

ON OUR TABLE.

Botany for High Schools and Colleges. By Chas. E Bessey, M. Sc., Ph. D. American Science Series. 8vo. pp. X, 611; with 573 cuts. New York. Henry Holt & Co. 1880. Price, $2.50.

Prof. Bessey has produced a well illustrated Botany for the Laboratory as well as for the class-room. The First Part, relating to General Anatomy and Physiology, follows the plan of Sach's treatise, but in a more elementary manner, so as to enable the pupil to go over the ground within the time usually allotted to the study in American colleges. In the Second Part however, which treats of Special Anatomy and Physiology, and which follows an order of Classification, the arrangement of the higher plants is more in accordance with that already followed in English and American text-books, while there is an improvement in placing the lowest orders first. In the classification of the "Cryptogams," modern views are adopted, and a fuller treatment of these groups places in the hands of the instructor the means of teaching the simple before the complex, and of placing the study upon a more scientific basis. If the importance of field work is not thereby lost sight of, the student of Prof. Bessey's book will become well versed in the elements of Botany. The introduction of this book cannot fail to produce beneficial results.

An Elementary Text-book of Botany. Translated from the German of Dr. K. Prantl. The translation revised by S. H. Vines, M. A., D. Sc., F. L. S. 8vo., pp. VIII, 332; with 273 cuts. Philadelphia: J. B. Lippincott & Co. 1880.

This work, written to serve as an introduction to Sach's larger "Text-book," which it resembles in mode of treatment, is divided into four parts: Morphology, Anatomy, Physiology and Classification. But it differs from its model in giving greater space to the subject of Classification, a feature which, while rendering the book less useful to the American beginner, as this part treats largely of European plants, has the advantage of producing a work valuable for study in connection with Gray's "Manual," or as an introduction to such a "Text-book" as that of Sach.

Brain-work and Overwork. By Dr. H. C. Wood. American Health Primers. Philadelphia: Presley Blakiston. 1880. 16mo., pp. 126. Price, 50 cents. From the Publisher.

School and Industrial Hygiene. By D. F. Lincoln, M. D. American Health Primers. Philadelphia: Presley Blakiston. 1880. 16mo., pp. 152. Price, 50 cents. From the Publisher.

Ueber die Entwicklung der Blumenfarben. By Dr. Hermann Müller. (Ext. "Kosmos"). Small 4to., double columns, pp. 16, (350-365). From the Author.

Die Bedeutung der Alpenblumen für die Blumentheorie. By. Dr. Hermann Müller. (Ext. "Kosmos," IV Jahrgang, Heft 4 (July, 1880). Small 4to., double columns, pp. 12 (276-287). From the Author.

The Characeae of America. By Timothy F. Allen, A. M., M. D. Boston: S. E. Cassino. Large 4to. Part I, pp. 7, pl. 3; Part II, pp. 6, pl. 3. From the Author and Publisher.

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EXTRACTS FROM CORRESPONDENCE.

Uselessness of Yeast Ferment.—According to your directions I have been experimenting with yeast ferment on Boll Worms and Cabbage Worms: it has had no visible effect on either. I tried it also on Aletia without effect.

I experimented yesterday on Aletia and Heliothis with extract of Pyrethrum, diluted, 40 parts water to one of extract. The result was that the small worms and about half of the large ones were killed. A larger proportion of Heliothis escaped than of Aletia.—R. W. Jones, Oxford, Miss.

No R. M. Locusts in Nebraska.—There has been no flight of *C. spretus* in Western Nebraska this season. I have not seen half a dozen individuals all summer. This Post is located about 120 miles north-west from the Loupe country, and is a good point for observation.—W. L. Carpenter, Fort Niobrara, Neb., Oct., 5, 1880.

Pyrethrum on Cabbage and Cotton Worms.—My experiments with the Pyrethrum Powder have generally been satisfactory, whether applied in a dry state or diluted in water. I tried the powder, in a dry state, at the rate of half an ounce to one hundred square feet planted in cabbages, which were infested with the larvæ of *Pieris rapæ*, and the worms were entirely destroyed or driven from the plants; not only this, but the butterflies ceased to visit the powdered cabbages, and resorted to the turnips and mustard. My experiments with the powder on the cotton plant were most gratifying, until the proportion used was less than one-quarter of a pound to the acre, and when the worms were more than half grown. When the worms were very small the least possible quantity of the powder seemed to exterminate them. I have not been able to see whether the powder tends to repel the moths of Aletia, as I am sure it repels the butterflies of *Pieris rapæ;* and yet one experiment, made by me, may indicate that the powder is offensive to the moths of Aletia, for they failed to feed upon persimmons sprinkled with Pyrethrum Powder, while they never failed to seek and feed with avidity upon persimmons sprinkled with cobalt, arsenic, Paris green and London purple. They also refused to feed upon persimmons poisoned with cyanide of potassium.—J. F. Bailey, Marion, Ala., Oct., 10, 1880.

Yeast Ferment for Cotton Worms.—I have tried many experiments with yeast and beer (a detailed description of which will be sent you), without any beneficial results so far as I can see. Both diluted yeast and beer attracted many insects, some of which, the wasps and yellow-jackets, attacked and carried off many of the cotton worms. The application of yeast and beer did indeed seem to inconvenience the worms, but no injury to their health, or diminution in their feeding was perceptible; nor were their numbers perceptibly lessened, except by the predatory insects named.—J. F. Bailey.

Pyrethrum in the Garden.—Prof. J. P. Stelle writes from San Marcos, Texas, as follows:

Two weeks ago Mr. J. V. Smith, the leading market gardener of this place, complained to me that he found it impossible to get a stand of turnips on account of the work of the flea-beetle immediately after the plants were through the ground, and also that the "green worm" and the harlequin or "spotted bug" were both at work ruining his cabbage crop. I gave him a small quantity of Pyrethrum Powder for test, and the annexed letter received from him to-day sets forth the result:

SAN MARCOS, TEXAS, Oct. 11, 1880.

PROF. J. P. STELLE,—*Dear Sir:* The Pyrethrum Powder which you kindly furnished me I put to careful test with the following results: I diluted it with wheat flour at the rate of five parts of flour to one part of Pyrethrum. This mixture I dusted over my cabbage and young turnips with extreme lightness, according to your directions. It entirely cleared the plants of insects. The flea-beetles immediately disappeared from my young turnips and gave me no further trouble. The green worms on my cabbage were killed—I found large numbers of them dead—while the spotted bug promptly took with a leaving, I found none of them dead, but not one has been seen on my cabbage since I dusted it with the mixture.—J. V. Smith.

Does the Baltimore Oriole feed on Doryphora?—Can any of your readers inform me if their observation confirms the statement made to me by a friend interested in ornithology and entomology, that the Baltimore Oriole lives and and feeds it young on the Potato Beetle? This gentleman told me that he had hesitated about planting potatoes in his garden, until he one day observed that a pair of these birds had built their nest close by, when he at once decided to plant, fully trusting, he said, to them to save his potatoes, which they did. He added that two

orioles, when rearing their young, would keep a quarter of an acre clear of beetles and larvæ.

This Oriole is not native or abundant in this part of the country. The gentleman alluded to above told me he well recollected seeing the first that he had ever known here, and on mentioning it and describing the bird he could not gain credence, as no one to whom he spoke had ever seen anything of the kind in this locality. This was about forty years ago. I should think some of your correspondents who live where the Oriole is more plentiful, can answer my query, and say whether this is a general habit of the bird, or only an accident of time or place.—E. W. Claypole, Yellow Springs, O.

Destruction of Fruit by Aletia.—The Aletia moths are still here in very great numbers. They are feeding now mainly upon the late apples and persimmons. They have destroyed all the wild grapes. In parts of the county, the moths are swarming around the Sorgho-evaporating-pans, and they are somewhat troublesome to the syrup-makers. They are also feeding upon the prickly-pear (*Cactus opuntia*), a fact hitherto unknown to me.—Jas. F. Bailey, Marion, Ala., Oct. 8, 1880.

Rare Beetle injurious to Sweet-potato roots in Louisiana.—I send you a Sweet-potato with more matured larvæ of *Cylas formicarius*. Keep it in a warm room, as cold weather will kill the larvæ. Since 1878 they are extremely rare and difficult to obtain. I believe that the heavy frost that year (3 inches ice in the streets here) killed nearly all, but they seem to increase again. In 1877 I raised 640 *Cylas* out of 11 potatoes. Cooked potatoes containing the larvæ turn so bitter that no chicken or hog will eat them. They will, in time, ruin the whole crop in the South.—Wm. Mische, New Orleans, La., October 19th.

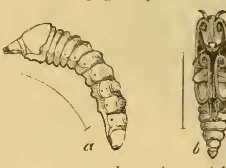
Aletia in New York State.—I found, Nov. 6, in an out-house on my premises, a fresh specimen of *Aletia argillacea*. It is interesting to note that from Oct. 16th to the 25th the weather was severe, with snow and frost; but for several days before Nov. 6 it had been warm. Oct. 16, 1878, this moth was plentiful here.—D. S. Kellicott, Buffalo, N. Y., Nov. 9, 1880.

ANSWERS TO CORRESPONDENTS.

Fungus Foes.—*J. J. Brown, Sheboygan, Wis.*—The fungus you send is infested by a strong colony of a small beetle, *Cis fuscipes* Mell., which is very commonly met with in all sorts of fungi that grow on old trees and logs. It belongs to the family *Cioidæ*, the numerous species of which are all known to inhabit such fungi. As these fungi are quite useless to man, the beetle cannot be considered as injurious.

The Twig Girdler.—I send you by mail a specimen of a Coleopterous insect, which, they say, is sawing off with its mandibles sapling pear trees, and branches from older pear trees. I send you also a specimen of a young pear tree sawed off by it. You will gratify a great deal of curiosity, which has been excited among those who have suffered by its ravages if you will kindly inform me what the name of this insect is, among entomologists, and whether it has any common name.—Wm. Rod. Maxwell.

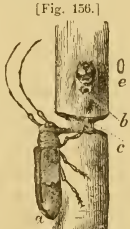
[Fig. 155.]



Oncideres cingulatus—*a*, larva; *b*, pupa (after Riley).

The insect sent is a rather large female of the Twig-Girdler (*Oncideres cingulatus* Say), which we herewith figure in its different stages. An account of it was given on page 76 of the first volume of this magazine. It is known to girdle a great number of different trees, among which may be mentioned Hickory, Elm, Persimmon, American linden, Pear, Apple, Peach and Plum. Both sexes of the beetle feed upon the bark of the hickory, but only the females, so far as we are aware, girdle the twigs. After partly girdling a particular twig she lays a number eggs in the distal portion that has been killed, each egg usually inserted just beneath a bud. The twig usually, though not always, breaks off by the force of the wind during winter, and the larvæ flourish upon the dead wood as it lies upon the ground, burrowing just beneath the bark, and when very numerous leaving little else than the outer bark. The beetles do this work in the fall of the year. The young larva hatches and works a short distance into the twig before winter sets in and continues working through spring and summer, transforming to pupa only towards autumn. Some writers have stated that two years are required for its development. While this may be true farther north it is not true of the latitude of St. Louis where we have reared the insect repeatedly from the egg.

[Fig. 156.]



Oncideres cingulatus: *a*, beetle girdling; *b*, point where egg is inserted; *c*, form of girdle; *e*, egg, extracted (after Riley).

The Bedeguar of the Rose.—Can insects create? Here is a bit of common briar bearing some kind of parasite, but observe that each tuft of the parasite springs out of the surface of bark within which is globuled a grub of the insect. Nowhere else on the plant does the parasite grow, nor will this parasite be found under other circumstances.—L. C. Bryan, Thomasville, Ga.

[Fig. 154.]

Bedeguar of the Rose.

The curled, fibrous, moss-like growth referred to by our correspondent is produced by a Gall-fly known as *Rhodites rosæ* Linn., which occurs both in this country and in Europe, where the gall is known as the "Bedeguar" of the rose. The larval cells are generally more numerous than in the specimen received, and the size of the mass of fibrous material varies greatly, but usually presents the appearance of the accompanying figure.

Minute Borers in Cherry, Peach and Plum Trees.—I send you by mail to-day, a small bottle of beetles, that for several years have destroyed all cherry, peach or plum trees set out on a particular lot at Fair Haven, on the south side of the North Shrewsbury river, two miles east from Red Bank. They do not appear to injure seed fruit as yet, and are confined to a small section. They bore little holes in the trees, which holes fill with gum, and the tree soon dies. —John L. Bennett, Red Bank, N. J.

With this find enclosed specimens of a small beetle, which has so profusely stung a young cherry tree, trunk and branches, that I expect it will not recover. If convenient I would like to know the systematic name of it.—M. H. Boyè, Coopersburg, Pa.

The beetle referred to in both the above inquiries is known to science as *Scolytus rugulosus* Ratzeburg and belongs to the family of *Scolytidæ* or Bark-borers, which are among the worst enemies to our forest and orchard trees and which are most difficult to deal with. The species in question is a native of Europe where it is found on Plum and Apple. Its introduction appears to be of recent date but, as in many similar cases, it has spread rapidly and does more damage here than in Europe. Dr. Leconte (Proc. Am. Phil. Soc., XIII., p. 626), who first identified this species, received it from Elmira, N. Y., where it attacked the Peach. We received it some years ago from Hillsboro', Mo., and Williamsport, Md., also attacking Peach, and it occurs in the District of Columbia. Most of the other species of the genus *Scolytus*, as far as their habits are known, attack forest trees: thus 4-*spinosus* Say (*S. caryæ* Riley) infests Hickory; *S. fagi* Walsh, Beech, especially in the South.

Smilax injured by Cut-worms.—I send you to-day a box containing four specimens of a Noctuid, the larva of which did much damage to our smilax plants (*Myrsiphyllum asparagoides*) by eating off all the softer parts, and especially the top of the plant. The larvæ occurred in great numbers; and to-day, or better, since the first of last week, the perfect insect appears in great number in our green-house.—Gustave Thommen, Lowell, Mass., Oct. 16th.

The moth is the Unarmed Rustic (*Agrotis saucia* Treit.), long known in this country as *A. inermis* Harr., it having lately been decided that the American and European insects are specifically identical. The larva is one of our commonest cut-worms, feeding upon and injuring a great variety of tender plants, and also climbing on to vines as in your case. We have designated the larva as the Variegated Cut-worm, on account of its markings, and it will be found figured on Pl. 1, Figs. 1 and 2 of our 1st Rept. on the Insects of Missouri. The eggs are laid in compact masses upon the twigs or leaves of trees. The young worms which, upon hatching, drop to the ground, have the first pair of prolegs reduced in size, and move by looping of the body, as in the case of the ordinary Canker-worm. The characteristic cut-worm habit of hiding near or beneath the ground during the day is not acquired until after the first moult. The eggs were first figured and described by us on page 188 of the 1st volume of this magazine.

Honey producing Oak-Gall.—I forward you by mail specimens of the oak galls from which the honey ant of Colorado (*Myrmecocystus hortus-deorum, var.*) obtains supplies of grape-sugar. Will you please let me know if the insect making the gall is known to you. Also, will you favor me with the substance of your remarks in Boston confirming my statement that the galls exude a sweet sap?—H. C. McCook, Phila., Pa.

A very brief statement of our remarks anent the exuding sachcarine matter from galls will be found on p. 284 of the present number. In reference to the gall sent by our correspondent, it is one that is found quite commonly in the Rocky Mountain region on *Quercus undulata*, as determined by Dr. Engelmann, who sent us the same gall in 1874, though we had previously collected it ourselves. It is, undoubtedly, an undescribed gall, and a very similar one occurs on the *Quercus macrocarpa* in the Missisippi valley. It has the ordinary woody texture that belongs to so many Cynipidous oak-stem galls, and the architect develops in a paler cell that occupies a large part of the interior of the gall. When fresh, the gall is quite bright-colored, inclining to crimson or scarlet. It seldom attains a larger size than an ordinary pea, and differs from similar galls in our cabinet by having frequently a rather broad, flattened crown, though this character is by no means constant. We would suggest for it the name of *Cynips quercus-mellaria.*